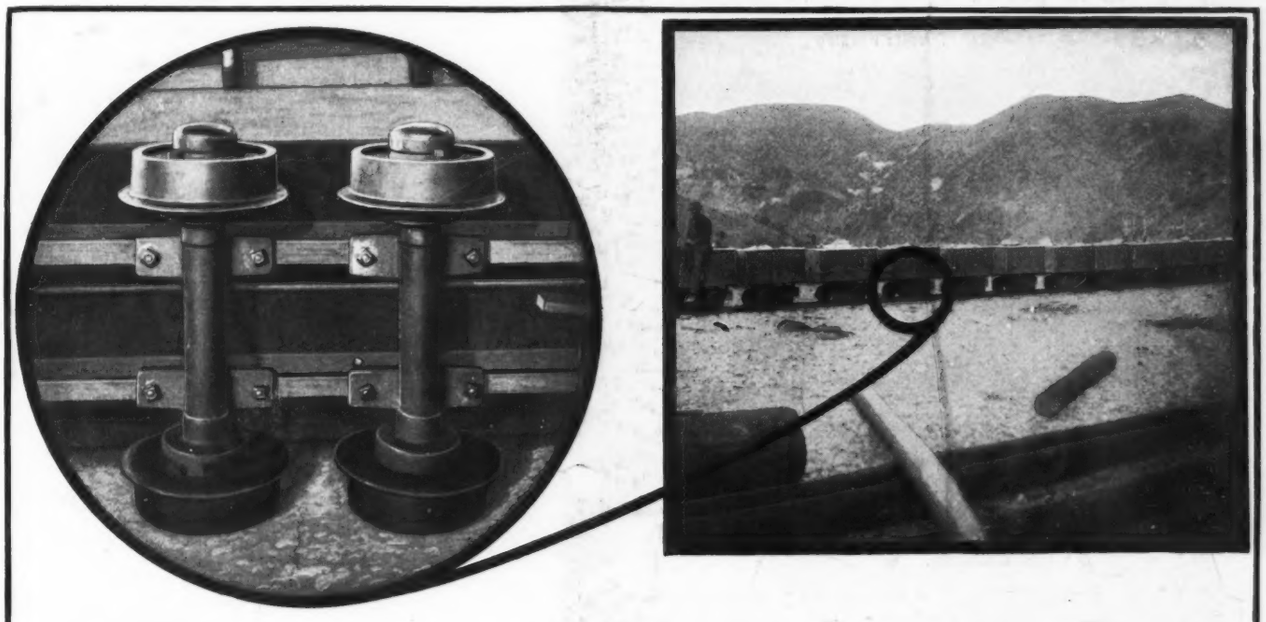
Engineering and Mining Journal

Volume 102, No. 14
Issued Every Saturday
Hill Publishing Company

NEW YORK, SEPTEMBER 30, 1916

Price, 15 Cents
Contents, First Page
Advertising Index, Last Page

SEP 30 1916
UNIV. OF MICH.
LIBRARY



The Bottom of Your Haulage Problem

LOOK at the bottom of this car. There is little difference between it and other types of mine cars. Yet this car will push or pull 50% easier—is more durable—and requires less attention than other cars. The car is equipped with Hyatt Flexible Roller Bearings.

The wheels on this car roll on the track. The axles roll in Hyatt Bearings. No sliding friction. A man can start a 4-Ton car with but little effort.

Mine Car Application is the title of a new catalog. It will help you to get to the bottom of your haulage problem. This book will be sent free to mine operators.

HY-FLEX-ROL

HYATT ROLLER BEARING CO.
NEWARK, NEW JERSEY

326

The S-A Page

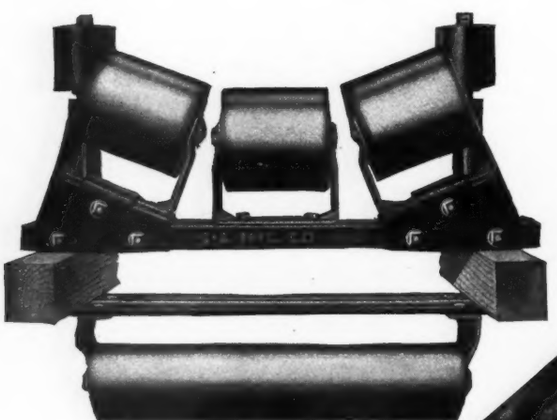
Published Weekly in the Interests of S-A Conveying Engineering

In these days of scarce and high-priced labor can you afford to use old-fashioned Grease Cup carriers? Try out the

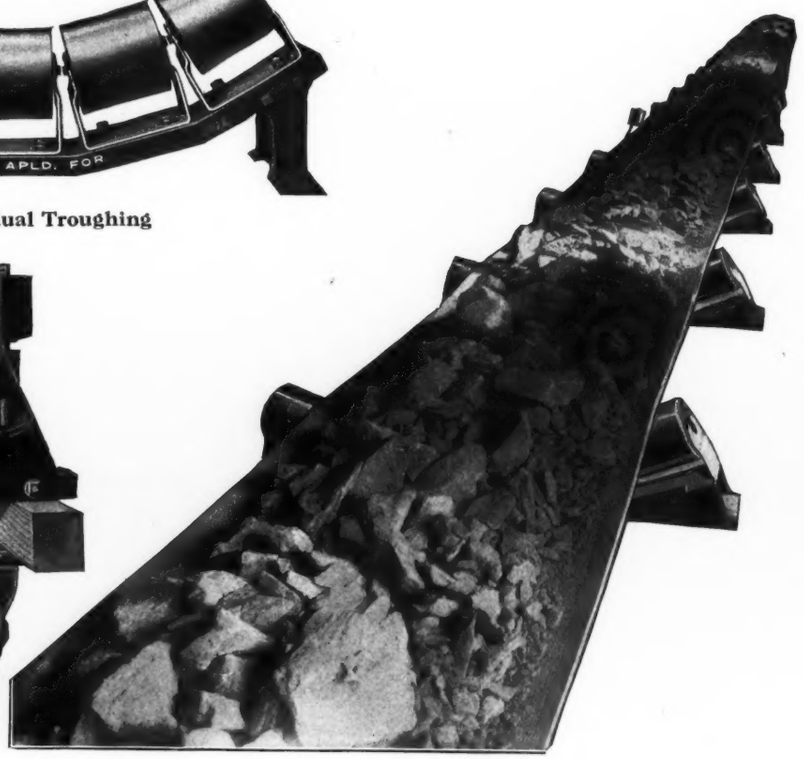
UNIT CARRIER at our expense

Trade Mark Reg. U. S. Patent Office
Patents Pending

Style 101—Gradual Troughing



Style 71—Twenty-Degree Troughing Rolls



If you could be relieved of the expense and bother of lubricating your automobile, wouldn't you jump at the chance? And isn't the expense and bother of lubricating old-fashioned Grease Cup Belt Conveyor Carriers great enough to make you sit up and take notice when we tell you that

the Unit Carrier will run from six to twelve months without lubrication and without attention; that it saves power and saves the conveyor belt as well.

This statement has been good enough for hundreds of the big users of Belt Conveyors. To all who wish proof we offer a free sample Unit Carrier to be tried out under your worst conditions. Write us giving the width and contour of your belt and we will gladly ship you a Unit Carrier out of stock to be given any test you wish.

Stephens-Adamson Mfg. Co. - Aurora, Ill.

Conveying, Screening — **Transmission Machinery**

Branches:

50 Church Street.....New York, N. Y.
First National Bank Bldg.....Chicago, Ill.
H. W. Oliver Bldg.....Pittsburgh, Pa.
Federal Reserve Bank Bldg.....St. Louis, Mo.
First National Bank Bldg..Huntington, W. Va.
503 Dooly Block.....Salt Lake City, Utah
J. W. Gates, District Manager.

79 Milk St.....Boston, Mass.
Colwell & McMullin, District Managers.
824 Dime Bank Bldg.....Detroit, Mich.
310 Stair Bldg.....Toronto, Ont.
E. J. Banfield, Agent.

Cable Address.....Saco

So. African Agent....J. MacG. Love & Co., Ltd.
1 and 3 London House, Loveday Street, Johannesburg, So. Africa.
Australian Agent.....Arthur Leplastrier & Co.
Circular Quay East, Sydney, Australia.
Scandinavian Agent.....C. S. Christensen, A/S
Post Box 85, Kristiania, Norway.

Engineering and Mining Journal

VOLUME 102 SEPTEMBER 30, 1916 NUMBER 14

The Lakeview Mine, Utah

By Douglas W. Jessup*

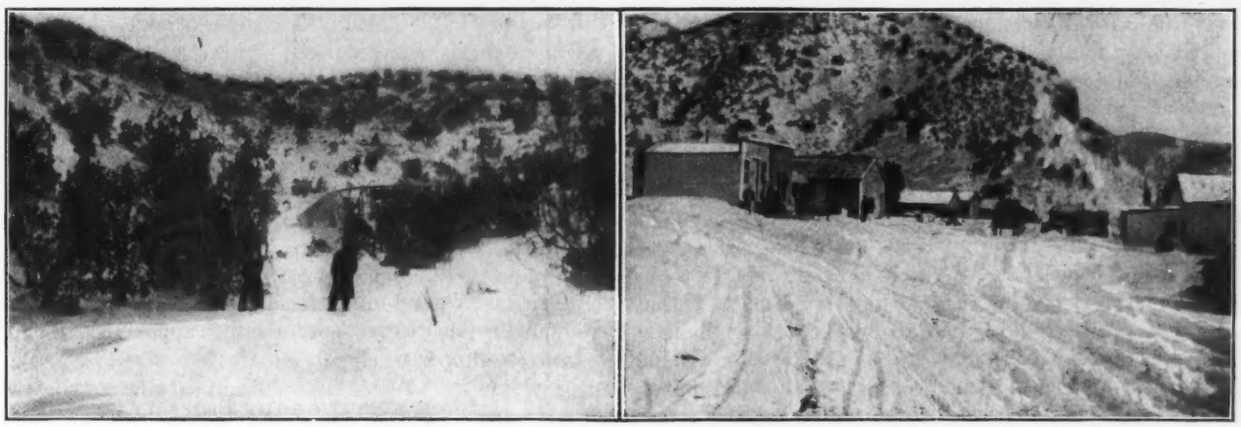
SYNOPSIS—The Lakeview mine is in a district not formerly known to be well mineralized. It promises to be one of the largest zinc producers of the West. It has been self-supporting, no money has been invested for development, and dividends have been paid. Other mines have come into existence in neighboring ground, stimulated by Lakeview's success.

The last year has seen the growth and development of the Lakeview mine, a property that gives promise of being one of the large zinc producers of the West. Not only has the mine been self-supporting from the grass roots, but after less than 6 months of operation, the first dividend was paid. Being a newly discovered orebody and in a district formerly supposed to contain but little mineral, the property as well as the district has commanded a great deal of attention and interest. In a report to the company, the manager, S. S. Arentz, supplied a large portion of the following data:

The property is 3½ mi. north of Saline, Boxelder County, Utah. The elevation is about 5,200 ft. and is 1,000 ft. above the level of Great Salt Lake. The shortest distance to the lake is less than one mile. The lower portion of the property contains the Lakeview townsite and is part of a former shore of the lake. The higher portion is more rugged and is partly covered with a growth of stubby cedar trees. The climate is semiarid; there is no running water and the vegetation is limited.

No mining of importance was done previous to the locations of the Lakeview Mining Co. The first discovery of mineral was made in 1907 on a thin seam of copper ore lying in a quartzite contact 1½ mi. northwest of Saline. Only a few pounds of ore was mined, and no shipments were made. In 1909 a company of Ogden men located two groups of placer claims covering a bed of marble-limestone and containing a large portion of the present mining company's property. Only assessment work was done, no marble being sent to market. In December, 1914, workmen walking up a wash leading to the outcropping limestone beds discovered boulders of lead-zinc carbonate and traced them to the outcrop of ore found in a contact between the so-called Middle Limestone bed and the Lakeview shale. Four claims were located, a few opencuts and holes were made in the outcrop, and a small quantity of ore was mined for shipment.

On Mar. 9, 1915, the Lakeview Mining Co. was incorporated. No stock was sold, all expenditures made by the original owners were returned to them and from May 1, less than 60 days of operating, the property was self-supporting.



VIEWS OF THE LAKEVIEW MINE AND THE TOWNSITE IN WINTER

The basal geological formation of the district in Archæn schist, which is overlain by a great series of massive quartzites, several thousand feet in thickness. The quartzite outcrops from along the shores of the lake, ¾ mi. west of the Lakeview mine, to the western edge of the property and to the base of the mountain. Overlying the quartzite is approximately 500 ft. of metamorphic shales, limestones and quartzites in thin beds, very dark in color and ranging from a green to a black. Resting upon these beds is 50 ft. of deeply stained limestone with outcrops of ore carrying from a trace to 3½% zinc. This is followed by 40 ft. of shaly limestone, then limestone shales capped by 50 ft. of marble-limestone on which the

*Mining engineer, Midvale, Utah.

original placer claims were located. A bed of shale 75 ft. wide, rests above the limestone, and this is followed by the middle bed, or ore-bearing limestone, 70 ft. in thickness. Overlying is another bed of shale from 50 to 75 ft. thick, and above this, running back for a distance of about 4 mi. to the east side of Promontory Point, is a series of thick limestone beds separated in places by marl and shale. The quartzite is pre-Cambrian, the limestones and shales range from Cambrian to Carboniferous.

The general strike of the beds is north 40° west with an easterly dip of 30° to 40°. The strike and dip bear the same regularity for three miles on the southern extremity of Promontory Point. On the Lakeview Mining Co.'s property, three cañons, bearing southwest to northeast, give a clear-cut exposure of the various beds and permit development by means of adits that expose the ore contact in the middle bed along its course. No fault displacements of any moment are noticeable to the east of the property, although numerous fissures indicate mineralization at depth.

The Middle Bed and Its Ore Deposits

All ore developed in the Lakeview property is found in the Middle-Bed limestone, and prospecting has developed ore for a distance of 4,500 ft. as measured along the outcrop. The outcrops are not conspicuous—in fact, just the reverse—and for this reason the district up to this time has been overlooked by the prospector in his search for minerals.

The ore occurs in a contact or bedding plane between a shale hanging and a limestone foot wall. It is found in chimneys, shoots and kidneys. The strike is north 40° west, the dip is 35° to the northeast and the rake of the oreshoots is to the north. The ore makes out into the soluble limestone along north and south fissures, sometimes as far as the shale beneath the middle-bed limestone. These north and south fissures are numerous; they are so close together that ore will make almost continuously along the bedding. The fissures show displacements in the main workings of from a few inches to one of 12 ft. They dip westerly. The faults are normal and show no displacement of the beds along the strike.

The metal content of the orebodies is principally lead and zinc. There is less than an ounce of silver and no copper or gold. The zinc occurs as smithsonite, or zinc carbonate, varying in color from white to dark brown. The lead, occurring in lesser quantities, is found as cerrusite, or lead carbonate, constituting about one-sixth of the ore. Barite, which occurs in large quantities and lies in contact with the hanging wall, is known as the ore indicator or lead. The lead ores are also found in contact with the hanging wall and the barite; the zinc ores underlie the lead and are in contact with the foot wall, often extending in the foot wall for several feet. The ores occur as regular replacement bodies, ranging from a narrow seam to bodies 30 ft. in width.

The carbonate ores have probably been produced by the solvent action of the mineral sulphates, formed by the oxidation of the sulphide minerals, and the solutions coming in contact with the limestone have precipitated the ores as carbonates. The district has undergone heavy weathering and erosion, and as the water level is at least 500 ft. below the surface, the ore is well oxidized. Near the surface the ore solutions have spread in the broken limestone, making deposits of a larger nature and intermixed with pieces of wall rock. A great deal of this is second-class ore and requires sorting. At a lower depth the solutions, being more confined, have made deposits of a better grade.

The original orebodies have been altered and leached. The soluble ores have been redeposited, probably at a lower depth. The open watercourses found in the contact indicate original ore channels from which the ore has been leached. While the orebodies found at a lower depth are more compact and of better grade, still they are not in as great quantity as the bodies nearer the surface. At water level the orebodies are often at their maximum size, this being due to the solvent action of the acid solutions upon the limestone forming large chambers favorable to the deposition of ores in quantity. So it may be reasonable to assume that when water level has been reached, orebodies of large size may be developed. Judging from the surface deposits, there seems to be a progressive decrease in zinc content with a consequent increase of lead content from the top toward the bottom of the ore channels. As this is contrary to the general formation of ore deposits, further developments will be awaited with interest.

It is a question whether the ore is confined at depth to the main contact. The Skyline tunnel was driven 75 ft. in ore and on the lower contact between the Middle-Bed limestone and the underlying shale. Here the ore channel reverses and dips to the southwest instead of northeast. The solutions may have followed up through this lower contact or may have migrated from the upper main ore contact. The spelter fissure, at the north end of the property, lies in the middle of the limestone bed; this is also true of the lead fissures in the Buckley tunnel toward the southern end of the property, but in both cases the ore seems to trend toward the main contact, perhaps following cross-fissures, to be deposited in a broken zone paralleling the main contact.

An igneous dike appears about 2,000 ft. northeast of the mine and above Grand View gulch. It is 4 ft. wide and can be traced for 150 ft. in a heavy bedded limestone. The dike is dioritic and undoubtedly has some bearing on the ore deposits. At the bottom of an incline sunk in the No. 1 tunnel, decomposed porphyry was encountered stained with copper, the first appearance of copper on the property.

Development of the Property

On the south side of the ridge, separating Lakeview gulch from Volunteer gulch, the property has been developed by six production and one development tunnels; on the north side of the ridge by three production and three minor tunnels. On the south side of Lakeview gulch and on the north slope of what is known as South Mountain, leasers have driven two tunnels and developed a 12-ft. body of lead ore. There are also several opencuts and minor workings along the contact. The tunnels are all driven along the main ore contact, between the Middle-Bed limestone and the overlying shale, with the exception of the first 1,000 ft. of No. 1 tunnel. A minor tunnel, called the Skyline, has developed the fissure of ore spoken of, in the lower contact.

The tunnels vary in length from 100 to 1,050 ft. The No. 1, or main production tunnel, is at an incline depth of 880 ft. below the top of the mountain ridge. The Complex, or lowest tunnel, is at an incline depth of 95

ft. below No. 1 tunnel. This tunnel is being rapidly pushed forward to develop the ore channels at depth and is now over 800 ft. in length. When completed, it will be used as the main working tunnel. Owing to the contour of the ground, this is the lowest tunnel obtainable and future deep development must be gained by sinking. From the Complex tunnel the ore above will be mined by overhand stoping, dropped into chutes to the tunnel level and hauled out by means of a mule train. The mined stopes will be filled with any waste or second-class ore extracted. Development below the tunnel level will be carried on by sinking a two-compartment inclined shaft on the contact, from which various tunnels and drifts will be driven to prospect and develop the ore channels. This incline will be extended to the surface to avoid the installation of an underground hoisting system. At the mouth of the tunnel will be placed the remainder of the surface equipment, including the ore and sorting bins, blacksmith shop, proposed narrow-gage railroad terminus and other

THE LOWER TRAIN BIN OF THE LAKEVIEW MINE

buildings. The mine contains over 11,000 ft. of workings, of which leasers have done 3,500 ft. Most of these workings are in ore.

There are 13 distinct ore channels or shoots more or less connected with one another, seven of which are quite pronounced. The various tunnels extend along the ore contact and intersect each channel. The ore between the levels is mined both by sinking and raising from one level to the other. Selective mining is practiced; either the lead or zinc ore is mined alone, or the high-grade zinc is mined separately from the low-grade. This requires careful mining and constant assaying. At times it is quite difficult to distinguish between the various kinds and grades of ore; a kidney of high-grade may be embedded in a kidney of low-grade ore, and there may be but little visible distinction between them.

The ore, being soft, is easily mined; a large amount of it is extracted by the use of the pick and shovel only. The harder ground requires hand steel, and a limited number of jackhamers are used. These are employed for drifting in the Complex tunnel and do satisfactory work. The broken ore is shoveled or loaded from the chutes into 16-cu.ft. mine cars, then trammed to the mouth of the tunnel and sent down surface chutes or pipes to the No. 1 tunnel level. Here it is dumped over a ½-in. mesh screen on the sorting floor; the fines are sent to the upper-tram bin of 80 tons capacity; the coarse is hand-sorted and joins the fines; the sorted waste goes to the second-class dump. From the upper-tram bin, the ore is carried down a 600-ft. gravity tram to an 80-ton ore bin. From this bin the ore is loaded for wagon haulage to the depot. The tram is a three-rail track with a one-car pass, gravity operating, and is fitted with a 4x5-ft. winding drum and band brake. The tramcars hold about 2,800 lb. of ore and are self-dumping. Three ore sorters are employed on the sorting floor. They stand on a platform built beneath the true floor and so avoid the excessive bending over. About one-sixth of the ore is waste and one-fourth is screening. The grade of ore is raised or lowered according to the price of zinc and the nature of the contract.

The ground stands exceptionally well; the stopes are not large, and but little timbering is required. A few stulls are used, and occasionally two posts and cap are necessary to hold up a loose piece of hanging wall. Rails of 8-lb. weight are used for track. The hand windlass is employed for hoisting from the inclines, the dumping platform being built above the track level from which the ore is dumped into the cars with a minimum amount of lifting. Owing to the high price of metals, the mining operations have been forced to produce ore in the quickest and best way possible and development of the property has not been carried on as it would be in normal times. The zinc ores have been mined almost to the exclusion of the lead ores, but now, with the drop in zinc prices, more attention will be paid to the production of lead.

Handling the Low-Grade Ores

The mine contains a large tonnage of ore carrying from 10 to 20% zinc as a carbonate and a lesser tonnage of mixed lead and zinc ores. This ore is of easy access. The dumps all carry high zinc content, ranging from 5 to 20%. Experiments are in view to separate the zinc from the lead by wet concentration and also by sulphidizing flotation. Calcining the ore has been considered, the zinc carbonate being roasted to zinc oxide with a loss in weight and a consequent increase in zinc content.

On the dump of No. 1 level are the tramway ore bin, sorting floor and blacksmith shop. The shop contains a distillate-driven compressor, also the necessary tools and equipment for sharpening steel, handling pipe, etc. The Lakeview townsite is about 1,000 ft. below the mine workings, just south of the ore bins and on a bench of a former lake shore. The buildings consist of a main office, boarding house, assay office, general store, pool hall, four bunkhouses, several dwellings, boarder tents, etc.

The road from the railroad station Saline to the mine is 3½ mi. long. Though somewhat dusty, it is in fair condition and of an even grade until a point 2,000 ft. from the mine is reached, when a 13% grade is encountered. Ore haulage is done by four-horse teams, wagon and trailer. Over 12 tons of ore is hauled per load at a cost of $1.25 per ton. A motor truck formerly employed for haulage was abandoned, the muddy condition of the roads in winter causing its withdrawal. A stock company has been incorporated to build a narrow-gage railroad from Promontory Point to the mine, a distance of 5½ mi., the gage to be 24 in. The ruling grade will be 2% with a maximum grade of 2½%. The road is expected to be in operation by next spring.

The power is all obtained from crude distillate costing 9c. per gal. Electric power can be obtained from Ogden, a distance of 20 mi.

There is no running water upon the property. At present all water is hauled from Ogden and delivered at the mine for 75c. a barrel. It is stored in a concrete cistern, built below the ground, and holding three tankloads. Two larger water tanks are being installed. A well is being driven 2,000 ft. west of the mine, and it is at a vertical depth of 150 ft.; water is expected at 250 ft., but the equipment is for 1,000 ft. The strata dip to the northeast and away from the well, which is about 600 ft. above the lake level, and only surface water can be expected.

The company is sinking a water shaft in the wash of Lakeview gulch and near the mine. The shaft has a hoisting compartment and manway. Its depth is 121 ft., of which 60 ft. is in wash. It will reach the main ore contact at a depth of 250 ft., and both ore and water are expected. There are several fresh-water springs near the lake shore, but the water is brackish. Piping water from the Maple Leaf Springs, 3 mi. northeast from the mine, has been considered.

Leasers Working on Property

A large portion of the property has been given out to leasers. They pay a certain royalty to the company regardless of the metal content of the ore, and they do a required amount of development work. The Western Zinc Co., or W. H. Clark lease, has leased the north and south extensions of the property, a portion of ground between the upper tunnels, and a block on the north side of the ridge below the No. 5, or upper, tunnel. This section has produced a large tonnage of ore averaging 33% zinc, which was mined from three tunnels. The ore was handled by outside chutes, dropped to a 25-ton ore bin and hauled by wagon to Saline, the railroad station. On the southern side of Lakeview gulch this company has developed a 12-ft. body of ore assaying 20% lead. Over 1,200 tons has been shipped. This body of ore has been developed by means of two tunnels known as the Buckley tunnels Nos. 1 and 2. The ore does not lie in the limestone-shale contact, but it is about 25 ft. away and in the limestone. The Clark lease has also shipped lead and zinc ores from surface workings near the No. 1 tunnel and developed a part of the lower, or Complex, tunnel. The operators have their own equipment, boarding house, etc.

The Volunteer Lakeview Co. has subleased one claim from the Lakeview Co. The claim has been developed by an incline shaft sunk in the ore contact. It is 156 ft. deep and pitches 33° to the north. Drifts at the 50-ft. and bottom levels, and two raises in the ore, have blocked considerable ore carrying from 5 to 20% zinc. This company also owns two claims adjoining the Lakeview property on the northwest. No ore has been shipped as yet, but a shipment is ready in the bin.

The Spelter lease contains the northern section of the Lakeview property. The operators have drifted in a body of zinc ore lying in the middle-bed limestone. One vein is about 40 ft. from the true shale hanging wall. There are several drifts, winzes and raises following oreshoots and water courses. The ore seems widely disseminated in the broken limestone and is of lower grade. No shipments have been made.

The Grandview Mining Co. adjoins the Lakeview on the north and northeast, with five unpatented claims. The workings consist of three minor tunnels, one 65-ft. incline and one 75-ft. vertical shaft. They all lie in a contact between a shale hanging and a limestone foot wall. Only ore of lower grade has been developed. The Cedar Ridge has seven unpatented claims adjoining the Lakeview on the northeast. The operators have prospected a shoot of zinc ore carrying from 10 to 20% zinc. The ore lies in the limestone and has been developed by one tunnel with two winzes. The Jay Hawk, also on the northeast, has five unpatented claims. There is but one short tunnel with two inclines sunk in mineralized limestone. A few hundred pounds of galena has been mined. This is the only discovery of galena in the district. The Promontory Development Co. and the Farr Lease are two properties at the extreme south of the Lakeview ore contact. They have small amounts of lead ore.

Shipping Ores from the Lakeview Property

The Lakeview Mining Co. and its leasers include the only ones in the district to have developed ore of shipping grade, in quantity. By careful mining and sorting some of the adjoining properties may be able to ship an occasional carload of ore. The higher grades seem to lie in the Middle-Bed or Lakeview contact and in that section of the contact between the Volunteer gulch and the territory just south of the Lakeview gulch.

From Apr. 15, 1915, when the first ore shipment was made, to Aug. 1, 1916, the company shipped over 10,000 tons of ore with a zinc content of 30% and over 500 tons of 20% lead ore. Company leasers have shipped over 3,000 tons of ore averaging 33% zinc, and 1,200 tons of ore carrying 20% lead. It has lately been decided to extend the operations of these leasers and give them more territory.

Dividends amounting to $150,000 have been paid to the stockholders, the property has been well equipped, mine buildings and cottages have been built and other surface equipment, amounting to a probable expenditure of $30,000. There is a large cash balance in the treasury. For every three dollars divided the company has attempted to place one dollar in the treasury for future development of the property.

Rhodesian Mineral Production

The total mineral production of Southern Rhodesia in 1915, according to *United States Commerce Reports*, was greater than that of 1914, which in turn was in excess of the output of 1913, which constituted the previous record. The yield of gold for the year was 915,029 oz., an increase of 60,548 oz. of fine gold. Among the 16 gold-producing countries of the British Empire, Rhodesia ranks fourth, being only slightly under Canada. The value of other minerals declared in Southern Rhodesia for the period under review was $2,802,646, as compared with $1,473,537 in 1914. The principal increases in mineral production other than gold were in copper and chrome ore, largely used in the manufacture of shells and other war materials.

The following table shows the quantities of principal minerals produced in Southern Rhodesia during 1914 and 1915:

Mineral	1914	1915
Gold, oz.	854,481	915,029
Silver, oz.	150,793	185,233
Coal, tons	349,459	409,763
Chrome iron, tons	48,207	60,581
Asbestos, tons	487	2,010

The copper production for the period Jan. 1-Sept. 30, 1915, totaled 2,594 tons. Dividends amounting to $2,732,438 were declared by Rhodesian mining companies during 1915, an increase of $357,152 on the amount declared in 1914. This sum does not include the profits made by local syndicates and individuals, which are said to have been substantial.

The copper production in the Transvaal shows a large increase over that of any preceding year. This is accounted for by the development of the mines at Messina, which are now turning out large quantities of this metal. The sales of copper in 1915 amounted in value to $1,988,778, a gain of $429,907 over the previous year. The copper output for 1916 promises to be larger than ever before, owing to increased development.

Mining Congress Meeting

The nineteenth annual session of the American Mining Congress, which meets in Chicago during the week beginning Nov. 13, promises to be marked by features of exceptional interest.

The addresses of welcome by Governor Edward F. Dunne of Illinois, Mayor W. H. Thompson of Chicago and President J. W. O'Leary of the Chicago Association of Commerce will be responded to by representatives of each mining state giving a carefully prepared three-minute resolution setting forth that state's most important mining issue. This expresion of opinion will have a guiding influence upon the work of the Resolutions Committee.

The general meeting to consider the subject of "Safety" will be addressed by Van. H. Manning, director of the United States Bureau of Mines, on the subject of "The Past and Future of Mine Safety Work."

At the Wednesday meeting to consider the subject of "Efficiency in Mining," Col. George Pope of Hartford, Conn., president of the National Manufacturers' Association, will make the principal address, to which Secretary of Labor Wilson is expected to reply. Honorable E. N. Hurley, chairman of the Federal Trade Commission, will also address this meeting.

The subject for Thursday will be "Conservation." Among the speakers on this subject will be Senator Phelan of California, and Hennen Jennings, of Washington, D. C.

The Zinc and Lead Section of the Congress will convene in its own meeting room at 2 p.m. Tuesday, with S. D. Nicholson, of Denver, Colo., as chairman. "Tariff for Revenue Related to a Compensating Duty on Lead and Zinc Ores" will be the title of the principal address, delivered by Otto Ruhl, of Joplin, Mo. J. H. Troutman, of the Empire Zinc Co., Denver, Colo., will address the meeting on the subject of the "Importance of Zinc in Preparedness." Other addresses will be made by W. B. Shackleford, R. M. Henderson, C. E. Siebenthal, F. G. Cottrell, Edward H. Nutter and H. C. George.

The Precious Metals Section of the Congress will meet in a room by itself on Tuesday, Nov. 14, at 2 p.m., with Irving T. Snyder, of Cripple Creek, presiding. Senator John F. Shafroth of Colorado will address the assembly on "The Future of Silver." Waldemar Lindgren will speak on "The World's Gold Supply and its Sufficiency for Business Needs." Thomas B. Stearns of Denver, president of the Denver Civic Association, will speak on "The Best Industry of the Rocky Mountains West," and W. R. Allen, of Butte, Mont., on "How to Protect the Small Investors in Metalliferous Mines."

On Thursday, with D. W. Brunton, of Denver, presiding, the committee on Revision of Mineral Land Laws is to report through its chairman, E. B. Kirby. Congressman M. D. Foster, of Illinois, chairman of the House Committee on Mines and Mining, will address this meeting on the subject of the "Foster Bill." Horace V. Winchell, of Minneapolis, is also to speak on this topic. The discussion promises to be warm and interesting.

Foreign Trade in Copper

Exports of copper from the United States in July are reported by the Department of Commerce as below, in pounds:

Ore and concentrates, contents	244,615
Unrefined, blister copper, etc.	4,492,264
Refined, bars, etc.	66,923,416
Old and scrap	55,463
Plates and sheets	688,900
Wire	4,606,193
Total copper	77,010,851

The weight of ore exported in July was 5,076 tons; of concentrates, 380 tons.

Imports of copper into the United States in July are reported by the Department of Commerce as below, in pounds:

Ore and concentrates, contents	13,413,073
Matte, contents	878,512
Unrefined, etc., in bars, pigs, etc.	27,027,316
Old, etc., for remanufacture	484,271
Composition, copper chief value	17,624
Total copper, lb.	41,820,796

Actual tonnage of copper-bearing material imported in July was 38,779 tons ore, 8,742 tons concentrates and 1,358 tons matte.

Scope of Extralateral Rights

By A. L. H. Street*

The Nevada Supreme Court has solved three important legal questions relating to mining rights under Section 2,322 of the United States Revised Statutes, which gives to locators the exclusive right to "all the surface included within the lines of their locations and of all veins, lodes and ledges throughout their entire depth, the top or apex of which lies inside of such surface lines . . . although such veins, lodes or ledges may so far depart from the perpendicular in their course as to extend outside the vertical side lines of such surface locations." The decision appears in the case of Jim Butler Tonopah Mining Co. vs. West End Consolidated Mining Co., 158 Pacific Reporter, 876, and the rules laid down are as follows:

Where a patented location is in the form of a parallelogram, except for the exclusion, for conflict, of a triangular piece at one corner, the remainder of what would have been the end line but for such exclusion is to be regarded as the end line for the purpose of determining the claimant's extralateral rights.

Under the statute quoted, extralateral rights may be claimed in opposite directions on a vein in the form of a single anticlinal fold.

The crest of a vein in the form of an anticlinal fold is the apex within the meaning of the law, a terminal edge not being essential to the existence of an apex.

*Attorney at law, 829 Security Building, Minneapolis, Minn.

Potash Plant at Searles Lake

Machinery is now being forwarded to a mill site near the patented land of the Pacific Coast Borax Co. at Searles Lake, Calif., where a commercial unit for the production of potash is expected to be in operation by Jan. 1, 1917, under the joint management of the Solvay Process Co. and the Pacific Coast Borax Co. Mention was made in the *Journal* of July 15, 1916, of the selection of the mill site, drilling of fresh-water wells and other preliminary work. Early this year the Borax company shipped two tank cars of Searles Lake brine to its Alameda works, where the method of potash recovery developed by the Solvay chemists was checked in a practical way by the technical staffs of both companies.

The output of the first commercial unit will be 40 tons per day of potassium chloride. During the first few weeks, only a 60 to 70% product will be made, but it is expected that the purity of the product will be brought up to 85 or 90% for the subsequent commercial output. It is planned to erect a second unit as soon as the first is completed and in running order. While no attempt will be made, during the period of present high prices for potash salts, to market the other salts contained in the Searles Lake brine, eventually, there will be an important output of sodium borate and soda ash as by-products from the potash plant.

Second National Exposition of Chemical Industries

The Second National Exposition of Chemical Industries opened at the Grand Central Palace, New York City, Monday afternoon, Sept. 25. There are about 200 exhibits in the hall, bearing testimony to the great advances made in the chemical industry in this country, particularly since the outbreak of the European War. The exhibits comprise what is probably the largest chemical demonstration ever made in this country and certainly show a remarkable development since last year. A large number of distinguished chemists and business men interested in industrial chemistry attended the opening ceremonies, and the American Chemical Society is holding its 53rd annual meeting simultaneously with the exposition, in order to obtain the benefit of the added interest and technical information that they can secure at the same time.

Among the novel exhibits is one of glassware, the expansion under heat of which is so small that it can be safely used for culinary purposes. Glassware of this sort, used particularly for laboratory purposes, was formerly imported from Germany, and the lack of it was so strongly felt that domestic companies were stimulated to begin its manufacture, which has, it seems, now been attended by complete success.

Another of the interesting exhibits is that of Thomas A. Edison, who, before the European War, imported many of his chemicals from Germany. From the outbreak of the war he immediately began to make plans to produce some of his most necessary materials and has succeeded in making them commercially. E. I. du Pont de Nemours & Co. are also supplying a special line of chemicals and intermediates upon a large scale.

Perhaps one of the most interesting exhibits at the exposition, at any rate to miners, is the series of moving pictures that forms a part of the United States Bureau of Mines exhibit. There are 11 films, which, in general, show how raw products are procured, how iron ore is mined, how cement is manufactured, the process of zinc mining, milling and smelting, and the mining and extraction of radium from carnotite ore.

Many of the exhibitors are well known to the mining profession, and among them may be mentioned the Dorr Co., Sweetland Filter Press Co., Kelly Filter Press Co., Abbe Engineering Co., Hardinge Conical Mill Co., Eimer & Amend, Foote Mineral Co., Huff Electrostatic Separating Co., Mine and Smelter Supply Co., Raritan Copper Works, Roessler & Hasslacher Chemical Co., Ruggles-Coles Engineering Co., and the Westinghouse interests. The American Institute of Mining Engineers and the United States Bureau of Mines are also well represented. A particularly attractive exhibit is that of "Anaconda Electric" zinc, shown by the Raritan Copper Works. Altogether the exhibit is a notable one, and anyone attending it will be well repaid for the time spent by the interesting and valuable information gained about the chemical industries of the United States.

Shannon Copper Co.

The report of the Shannon Copper Co. for the first half of 1916 shows a total production of 4,376,199 lb. of copper, which cost 17.2c. per lb. to produce. The average selling price was 27.363c. per lb., leaving a profit of 10.163c. The property was operated for five months only, being closed in January on account of the strike. Production and profits are shown in the following table:

PRODUCTION AND PROFITS OF THE SHANNON COPPER CO.

	Production, Lb.	Profits
February	667,000	$66,698.80
March	678,000	63,447.94
April	977,000	109,180.83
May	1,067,000	126,627.28
June	987,000	82,441.55
	4,376,000	$448,396.40

Deducting $14,176, expenses in January while the property was not running, leaves a balance of $434,220 net profit. Current assets on June 30, 1916, in excess of current liabilities amounted to $991,407, exclusive of the $388,000 of Shannon Arizona Railway Co.'s first mortgage bonds in the company's treasury on June 30, 1916.

Information on Alloys

The American Institute of Metals has communicated to its members a request made by Dr. G. K. Burgess, chief of the Division of Metallurgy, Bureau of Standards, Washington, D. C., that at the fall meeting of the Advisory Committee, representatives of the Institute have available as much information on the properties of various alloys as possible. Dr. Burgess' idea is to make the bureau a clearing house for such information in order to accumulate reliable experience tables.

Bismuth from Peru is exported in the form of concentrates, according to a recent consular report. The production in the last four years has varied from 24 to 81 tons, all of it exported. The principal mine is the San Gregorio in the Cerro de Pasco district. Its production is limited as it has been controlled by the trust which formerly included the Saxon State mine administration at Freiburg, the Deutsche Gold- und Silberscheide Anstalt at Frankfurt and Johnson, Mathey & Co. at Liverpool. This trust has been broken up by the war, but Johnson, Mathey & Co. continue to control the mine and limit shipments, which could be much increased.

Electrolytic Precipitation from Cyanide Solutions

By G. H. Clevenger*

SYNOPSIS—A discussion of the possibilities of electrolysis as a precipitant in cyanide process. While previous attempts have been partly successful, the great area of cathode surface required and the difficulty of providing proper solution agitation have been serious obstacles.

Some time ago I presented a paper[1] upon this subject to the American Electrochemical Society. This paper was confined to practice, up to that time, as carried on under plant conditions, there being no attempt to discuss the data presented or to suggest possible points of improvement for new installations. The case would therefore be somewhat better for electrolytic precipitation plants than this paper would indicate if designed, built and operated upon sound electrochemical principles and with proper cognizance of previous experience.

The accompanying table, compiled under my direction from data collected from all available sources, gives the essential features of electrolytic precipitation as previ-

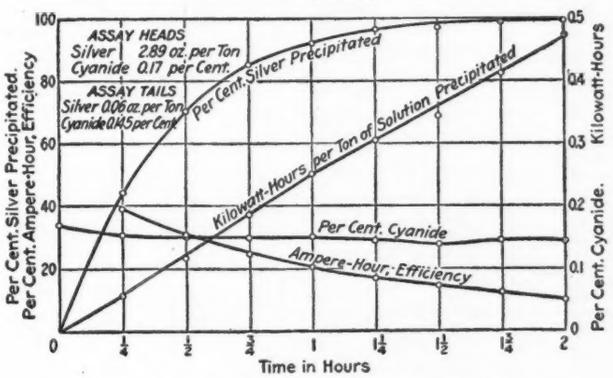


FIG. 1. PRECIPITATION FROM FRESH CYANIDE SOLUTION

ously practiced. In general, the lower percentage of precipitation of the gold and silver as compared with chemical methods of precipitation is to be noted. In the case of the Butters installations this was intentional, as all the solution used for final washes was passed through zinc after leaving the electrolytic boxes since, with the equipment used, this was found more economical than to attempt complete precipitation by electrolysis.

It is a well-known fact that as the proportion of metal in solution decreases, the difficulties of precipitation increase. Thus it may require as great an electrode surface, as long a time and as great a consumption of power to precipitate the last 10% of the gold and silver as the first 90%. This is illustrated by the curves shown in Figs. 1 and 2, which embody the results of small-scale experiments in which the solution was agitated throughout electrolysis by means of a small wooden propeller driven by an electric motor. Fig. 1 shows the results upon a fresh cyanide solution containing silver. The loss of cyanide during precipitation is apparent. Since most of this took place at the beginning of the test, it is possible that there was a mistake in the original titration. Fig. 2 shows the results upon Tonopah Extension mill solution of very nearly the same silver content. In this case a gradual increase in the cyanide strength up to the end of the test is to be noted. This is to be expected of a mill solution containing zinc and sulphocyanate.

The Rapidity of Electrolytic Precipitation

It has been pointed out on many occasions that metals in solution can be precipitated by electrolysis only as fast as they are brought in contact with the electrodes. When it is remembered that it is only the thin film of solution in contact with the cathode from which precipitation is taking place, the necessity for agitation or rapid movement of the solution in order that the thin film of impoverished solution may be rapidly removed and replaced by solution containing the metal is apparent. This becomes of greater importance as the metal content of the solution decreases. In none of the previous installations for electrolytic precipitation was proper provision made for the rapid movement of the solution necessary if the best results are to be attained. Invariably the practice was to allow the solution to pass gently by gravity flow through the compartments in which the electrodes

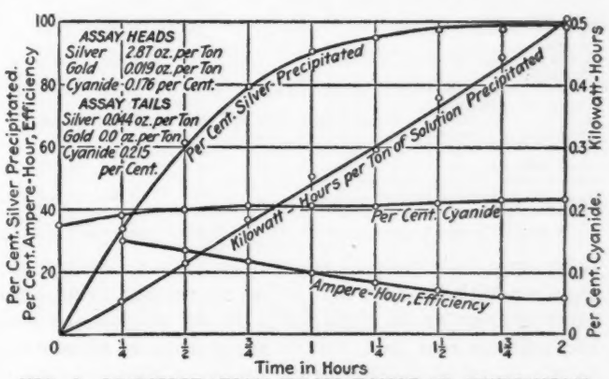


FIG. 2. PRECIPITATION FROM TONOPAH EXTENSION MILL SOLUTION

were suspended. This feature of the process much resembled the gentle flow of solution through the boxes used for zinc-shaving precipitation. Agitation could be accomplished by mechanical stirring gear or by circulating the solution by means of centrifugal pumps. The latter proposal perhaps has the advantage, although with such a system care would have to be exercised that the solution was properly distributed. The lack of proper agitation in some of the older plants sometimes manifested itself by the formation of insoluble silver cyanide at the anode. With proper agitation this would never occur so long as free cyanide was present. The necessity for proper movement or agitation of the solution cannot be too strongly emphasized.

*Associate professor of metallurgy, Leland Stanford, Jr., University, Palo Alto, Calif.

[1] "The Electrolytic Precipitation of Gold, Silver and Copper from Cyanide Solutions"; by G. H Clevenger. "Trans. Amer. Electrochem. Soc.," Vol. XXVIII, pp. 263, 306.

It will be noted that of the plants tabulated those using the Siemens-Halske process invariably used an iron anode. The iron anode has the disadvantage of rather rapid disintegration unless the current density be very low. This results in the formation of either prussian blue or ferric hydroxide, the former being particularly objectionable. The other plants cited used the peroxidized-lead anode. With high current density this is an improvement, as there are no troublesome iron compounds to deal with, the anode has a reasonable life and, when finally discarded, has a salvage value for the lead and other metals[2] that it may contain. The anodes have ever been a source of weakness in electrolytic precipitation. It is therefore not surprising that other materials have been experimented with, but unfortunately some of the more recent proposals have not been tried upon a working scale. Hard carbon was early tried upon a large scale by von Gernet, but, as pointed out by him, it was abandoned because in the course of time it formed compounds with the cyanide and disintegrated. Acheson graphite has also been tried upon a working scale, and though this material gives splendid results with certain electrolytes, it does not seem to be suitable for cyanide solutions. In time it behaves somewhat like carbon, and after a sufficiently long time it becomes disintegrated and mushy. This disadvantage, together with the fact that it has no salvage value, indicates that as anode material it is not so good as lead. High-silicon cast iron, which has proven so satisfactory in the chemical industries for resisting the corrosion of acids, has been suggested as an anode material. In the absence of large-scale, continued tests, definite statements regarding it cannot be made, but I am inclined to think that it would not prove so satisfactory in alkaline solutions.

Fused iron oxide or magnetite electrodes were developed in connection with the caustic-soda industry in Germany. They have been experimented with as an insoluble anode material in various electrolytic industries in this country. The large electrolytic precipitation plant for copper at the Chuquicamata mine in Chile was originally equipped with these anodes. More recently, a large number of them have been replaced by high-silicon iron on account of the difficulty of obtaining the magnetite electrodes, but it must be borne in mind that precipitation of copper is here carried on in a sulphuric-acid solution. My own experience with this material in an experimental way leads me to believe that it would not be advantageous for use in cyanide work, as its original cost is rather high, it is very brittle, and under this condition of use it probably would not have an indefinite life, as has been sometimes claimed, and furthermore, when discarded, it would have no salvage value. In order to save weight and give a reasonable surface, the magnetite electrodes are cast hollow and provision for electrical connection is made by plating copper or some other metal on the inner surface of the electrode. The electrical connection is soldered or connected by some other suitable means to this metallic sheet. This makes an ideal electrical connection, but unfortunately constitutes a point of weakness. The fused iron oxide, being very brittle, almost invariably contains microscopic cracks, which extend from the surface in to the metallic contact. The solution undergoing electrolysis finds its way through these cracks, when it is but a matter of a short time before the metallic coating is destroyed. Furthermore, the electrodes are fragile and require careful handling. Passive iron is an interesting possibility, but since its properties are probably due to a thin coating, it seems probable that once this coating is broken or destroyed, the electrode would present no advantage over an ordinary iron electrode. However, a large-scale test of this material would be very interesting and might prove it suitable for this purpose. Various other anode materials have been experimented with, applied in various ways, but so far with no very promising results.

TABLE SHOWING THE ELECTROLYTIC PRECIPITATION OF

System	Location of Plant	Tons of Solution Precipitated per 24 Hr.	Oz. per Ton Gold	Oz. per Ton Silver	% Copper	% Cyanide	Points Alkalinity	Anode	Cathode	Sq.Ft. of Surface per Ton of Solution Precipitated per 24 Hr. Anode	Sq.Ft. of Surface per Ton of Solution Precipitated per 24 Hr. Cathode	Distance Between Electrodes, In.	Voltage Across Anodes and Cathodes
Siemens-Halske	von Gernet's General data	100	0.25	Trace	None	.....	...	Iron	Lead foil	100	100	1½	4 to 8
Siemens-Halske	Croesus, Rand, S. Africa	50	0.100	Trace	None	0.05 to 0.15	...	Iron	Lead foil	64.8	153.6	1½	.....
Siemens-Halske	May Consolidated (sand) Rand, S. Africa	300	0.25	Trace	None	0.02 to 0.08	...	Iron	Lead foil	46.1	‡	1½	.....
Siemens-Halske	May Consolidated (slime) Rand, S. Africa	320	0.05	Trace	None	0.08	...	Iron	Lead foil	52.8	‡	1½	.....
Siemens-Halske	Lancaster West Rand, S. Africa	154	0.194	Trace	None	0.03 to 0.10	...	Iron	Lead foil	59.9	‡	1½	.....
Siemens-Halske	Ferreira (slime) Rand, S. Africa	...	0.035	Trace	None	0.017	...	Iron	Lead foil	.....	.....	1½	.....
Butters-Andreoli	Minas Prietas (sand) Mexico	216	0.147	3.51	*	0.0792	...	Peroxidized lead	Tin plate	29.3	27.7	3¾	3
Butters-Andreoli	Minas Prietas (slime) Mexico	480	0.055	1.45	*	0.0409	...	Peroxidized lead	Tin plate	26.4	24.9	3¾	2.6
Butters-Andreoli	San Sebastian, Salvador	150	0.79	Trace	0.075	0.118	...	Peroxidized lead	Sheet lead	48.9	46.9	2½	4 to 4.5
Butters-Andreoli	Virginia City (Comstock Tailing) Nevada	474 to 668	0.033	0.78	†	0.046	6	Peroxidized lead	Tin plate	30.6 to 21.7	30.3 to 21.7	3¾	3.1
Butters-Andreoli	Virginia City (Comstock Tailing & Tonopah, Ore.)	432	0.055	3.15	†	0.18	10	Peroxidized lead	Tin plate	33.6	33.6	3¾	3.1 to 3.2
Butters-Andreoli	El Rayo, Mexico	200	0.30	5.00	0.12	0.15	100	Peroxidized lead	Sheet copper	9.7	9.3	2½	.....
Siemens-Halske	Reliance Mill, Nelson, B. C.	150	0.06	Trace	None	0.01 to 0.05	13	Iron	Sheet lead	70	70	1½	4 to 5

* Ratio of copper to silver about ½ to 1. † Ratio of copper to silver about 3 to 1. ‡ Cathode surface assumed to be the same as the anode surface.

Peroxidized Lead as Anode Material

On the whole then, so far as now known, peroxidized lead is the most satisfactory anode material. Under ordinary conditions, when properly prepared, such electrodes have a life of approximately one year, and at the end of this period they have a certain salvage value for the lead and other valuable metals that they may then contain. They may be either shipped or treated locally.

The cathodes commonly used have been sheet lead, tin plate, and occasionally aluminum. The use of aluminum, although it has advantages when a nonadherent deposit

[2]After long-continued use, the lead anodes contain more or less gold and silver as a result of reactions which cause premature precipitation of these metals at the anode.

is desired, may be dismissed on the score of expense, as well as on account of its tendency to disintegrate in an alkaline solution when the current is off. Sheet lead, on account of its fragile nature, is not satisfactory for a nonadherent deposit which necessitates brushing and scraping the cathodes. Tin plate has the advantages of being cheap and of having the necessary strength to resist the operation of brushing or scraping. From the electrochemical standpoint, iron is not the best metal to use as a cathode, but a certain amount of disadvantage in this direction can be tolerated for the sake of overcoming mechanical difficulties. The recent proposal of a paper cathode looks good, but so far as I am aware it has not been tried upon a working scale. The question of cathodes then seems to resolve itself into the proposition of using tin plate with a nonadherent deposit and thin sheet lead, or possibly paper, with an adherent deposit.

One serious objection to electrolytic precipitation has been the large electrode surface required, which necessitates large and unwieldy units. The compactness of the equipment for zinc- or aluminum-dust precipitation, or even that for zinc-shaving precipitation, as compared with the old type of electrolytic unit, is apparent. The question naturally arises whether it is possible to cut down the electrode surface required per ton of solution precipitated. While much may be accomplished in this direction, yet there is a certain limit beyond which it is not feasible to go. With efficient agitation it is reasonable to assume that the current density could be considerably increased and a reasonable efficiency still be maintained. It must, however, be borne in mind that the solutions to be dealt with in cyanide practice contain a comparatively small proportion of dissolved salts. Therefore the solutions to be precipitated are poor electrical conductors. The only way to mitigate this difficulty appears to be to carry in the solution a certain proportion of some cheap inert salt which will serve to increase the conductivity. This practice would not be without its complications, for it would mean increased cost and the possibility of interference through unwelcome chemical reactions. Notwithstanding these disadvantages, this idea seems to be worthy of a trial. Since there is a rather severe limitation upon the conductivity of the solution, the only other ways that the current density can be increased are either to increase the voltage or to space the electrodes closer together.

GOLD, SILVER AND COPPER FROM CYANIDE MILL SOLUTIONS

Current Density at Cathode (Amperes) per Sq.Ft.	per Sq.M.	Percentage Precipitated by Electrolysis Gold	Silver	Copper	Cyanide Regenerated, Gain in %	Nature of Deposit	Metals in Deposit	% Current Efficiency	Life of Anodes	Kilowatt Hours Per Ton of Solution Precipitated	Per Lb. Metal Deposited	Remarks
0.03 to 0.06	0.323 to 0.646	85 to 95	....	....	Showed a loss	Adherent plating	Gold	1.48 to 0.740	**	0.288 to 1.15	16.8 to 67.1	Electrolytic precipitation exclusively
0.04	0.431	100	....	....	Showed a loss	Adherent plating	Gold	0.29	††	.....	.....	Electrolytic precipitation exclusively
0.04	0.431	85	....	....	Showed a loss	Adherent plating	Gold	2.03	††	.....	.....	Electrolytic precipitation exclusively
0.04	0.431	90	....	....	Showed a loss	Adherent plating	Gold	0.37	††	.....	.....	Electrolytic precipitation exclusively
0.04	0.431	77.4	....	....	Showed a loss	Adherent plating	Gold	1.10	††	.....	.....	Electrolytic precipitation exclusively
0.04	0.431	82	....	....	Showed a loss	Adherent plating	Gold	....	††	.....	.....	Electrolytic precipitation exclusively
0.55	5.92	91	91.7	....	0.0146	Flocculent and slightly adherent	Gold, Silver and copper	7.01 to 16.48	Over 12 months	1.1	3.67	Electrolytic precipitation exclusively
0.30	3.23	88	89.6	....	0.0118	Flocculent and slightly adherent	Gold, silver and copper	7.01 to 16.48	Over 12 months	4.6	40.2	Electrolytic precipitation exclusively
1.00	10.76	80 to 90	....	36.0	0.036	Adherent plating	Gold, copper and likely zinc	18.93§ and 12.47‖	8 to 12 months	4.5 to 5.07	7.52 and 12.67	Electrolytic precipitation followed by zinc
0.245	2.64	70	71.8	....	0.02	Flocculent and slightly adherent	Gold, silver, copper and likely zinc	27.15 to 38.26	12 months	.....	.....	Electrolytic precipitation followed by zinc
0.245	2.64	63.6	71.4	....	No gain or loss	Flocculent and slightly adherent	Gold, silver, copper and likely zinc	....	12 months	6.17 to 6.37	39.75 to 41.0	Electrolytic precipitation followed by zinc
1.20	12.92	65	65	20	0.075	Flocculent and slightly adherent	Gold, silver, copper and likely zinc	77.95	Short	.....	.....	Original plan; zinc precipitation preceded electrolytic precipitation; later, order was reversed
0.02 to 0.03	0.215 to 0.323	Over 90	....	....	No gain or loss	Adherent plating	Gold	0.68 to 0.45	.....	0.19	46.1	Electrolytic precipitation exclusively

§ May-1906. ‖ June-1906. ** In a plant treating 100 tons per month, 1,080 pounds of iron were consumed (von Ge.net). †† 0.33 to 0.67 pounds of iron consumed per ton.

Increasing the voltage has several serious disadvantages. It causes certain undesired reactions to take place, which result in a lowered efficiency; it increases the liability of short-circuits, and furthermore, it greatly increases the power consumption. This is best emphasized by the old saying that "amperes bring money," while "volts cost money." While in all electrochemical work the voltage should be reduced as far as possible, there is a certain minimum voltage below which it is impossible to go if the reaction is to proceed. This places the lower limit upon the voltage, while the considerations just mentioned tend to impose the upper limit. The Gibbs-Helmholtz[3] equation for calculating the electromotive force required for a chemical reaction to take place in an electrolytic cell is

$$e = 0.0000434\,\frac{W}{n} + \frac{Tde}{dT},$$

in which

e = E.m.f. in volts necessary in order that the desired reaction may go on;

W = The total energy of the reaction in gram-calories per gram-atom of metal deposited;

n = Valence of the deposited metal;

T = Temperature in absolute degrees Centigrade;

$\frac{de}{dT}$ = Temperature coefficient of the e.m.f. at the temperature T.

For all practical purposes $\frac{Tde}{dT}$ may be neglected. The equation then becomes Thomson's rule:

$$e = 0.0000434\,\frac{W}{n}$$

As regards the spacing of the electrodes, the limitation placed upon this is the liability of short-circuiting. In the commercial plants formerly operated it has not seemed practicable to space the electrodes much closer than 1½ in. However, I am of the opinion that with a carefully worked-out design and care in operation closer spacing could be used. The particular difficulty with short-circuiting comes about through the tendency of the electrodes, while in use, to warp and buckle. One

[3]See the paper on "Electrometallurgy," by Dr. E. F. Roeber. Volume on "Metallurgy," "Transactions of the International Engineering Congress."

possibility that suggests itself would be to have two units, one for the precipitation of say 80 or 90% of the metal, and the other which would take only the amount of solution from the first unit that it would be necessary to completely precipitate for final washes. This second unit could be especially constructed so as to give much closer spacing of the electrodes. These two units would comprise an electrolytic precipitation equipment for operation along the lines of a complete and partial precipitation circuit such as has proved so advantageous with zinc-dust precipitation. The two-unit plan is not unknown in actual plant operation.

Much has been said regarding the regeneration of cyanide when electrolytic precipitation is used. My own experience is that with anything like complete precipitation little gain in cyanide strength can be hoped for. With partial precipitation, there would be rendered available a portion of the cyanide liberated through the decomposition of the potassium-silver cyanide, as well as through the decomposition at the anode of the sulphocyanate. In this connection it is well to bear in mind that electrolytic precipitation is the only known method of precipitation that breaks down this salt and renders available the cyanide that it contains. With judicious use of electrolytic precipitation, I am of the opinion that the cyanide balance sheet would show up fully as well as with either aluminum or zinc precipitation. There is, however, a chance that this would not be the case on account of the fact that the solutions resulting from electrolytic precipitation would be more subject to atmospheric decomposition than would the solutions from zinc precipitation, in this respect being much the same as solutions resulting from aluminum precipitation. In the case of an ore which produced much sulphocyanate, the gain from the reduction of the sulphocyanate might easily more than counteract this tendency. The best results as regards cyanide regeneration of course would be obtained with proper agitation.

In the past, byproducts have been a great bugbear with electrolytic precipitation. Much of this difficulty can be overcome, but in my opinion byproducts with the best practice would be more in evidence than under the present methods of precipitation. Whether the old general plan of containing box, providing for agitation in the compartments containing the electrodes and employing a continuous flow of solution would yield the best results, or an entirely new system, in which many electrodes were suspended in a few large tanks where the solution would be precipitated in charges, I am not prepared to say. On the whole, electrolytic precipitation, used either alone or in combination with a chemical precipitant, would prove most advantageous on silver or silver-gold ores where there was a considerable bulk of metal to precipitate and where there was a decided tendency for the formation of sulphocyanate. With ores containing much copper it is a necessity.

⁂

The Silica (Quartz) Sold in 1915 for pottery, tile, glazes, paints, wood-filler, wood-polish, abrasive soaps, fine filters, and other uses, as reported to the U. S. Geological Survey, amounted to 243,340 short tons, valued at $1,270,835. This product was obtained from quartz veins, pegmatites, quartzites, sandstones, sand, tripoli, and diatomaceous earth in Arizona, California, Connecticut, Illinois, Maine, Maryland, Massachusetts, Michigan, Missouri, Nevada, New Hampshire, New York, North Carolina, Oregon, Pennsylvania, Tennessee, Virginia and Wisconsin.

Tin Production in Siam

The tin output of Siam, according to a consular report, comes principally from the State of Puket, which is a Malay state, but is owned by Siam. It includes the provinces of Takuapa, Pangnga, Renong, Trang, and others to the west of the main watershed of the Malay Peninsula. A recent report says that present tin operations in Takuapa are in the hands of the Chinese. The output from the district has for the last few years slightly exceeded 500 tons annually, but it has declined since the commencement of the war. During the year ended March 31, 1915, 497 tons of metallic tin were recovered, while the amount for the succeeding nine months was 252 tons.

Some years ago a Danish company obtained a concession at Pong, some 500 acres in extent, for mining purposes. A subsidiary company was formed in London to work this area and others at Huey Yawt in Monthon Puket and at Nong Pet near Ronphibun in the adjoining Monthon of Nakon Sritamarat. This company expected its bucket dredge to arrive at the end of April, 1916, but, owing to difficulties of transport between Takuapa and Pong, it will not be possible to commence mining operations before April, 1917. The ground is said to average 1 lb. of tin oxide to the cubic yard, this being considered a satisfactory metal content.

Pangnga, like Takuapa, is mainly devoted to the production of tin, of which over 800 tons have been recovered during each of the last two years. For the nine months ended Dec. 31 last, over 950 tons of metallic tin were produced, a considerable increase thus being shown.

Taimuang, some 40 miles from the town of Pangnga, is peopled almost entirely by Chinese, who are engaged in mining operations. The output of tin from the Muang of Pangnga is likely to increase in the future, while that from Taimuang is expected to remain stationary for the next three years, after which a rapid decline is anticipated.

⁂

Rights of Mining Engineers

By A. L. H. Street*

The Federal Bankruptcy Act provides that in the distribution of a bankrupt's assets priority shall be given to claims of "workmen, clerks and servants" for unpaid wages, and a mining engineer who had been employed at an annual salary of $4,000 by a mining firm that became bankrupt claimed the benefit of the statute. The United States District Court for the District of Massachusetts holds, however, that he was not entitled to a preference over general creditors.

Finding that the claimant's duties consisted in advising and assisting the superintendent in developing and operating the mine, exploring the mine, preparing plans, making cost sheets and forms for payrolls, inspecting the mine and machinery, etc., the court says: "I doubt whether the earnings of a professional man, employed primarily because of his learning and his ability to advise helpfully, are properly described as 'wages'; and I do not think that the man himself is a 'workman, clerk or servant,' within this section." (In re Gay & Sturgis, 233 Federal Reporter, 604.)

---

*Attorney at law, 829 Security Building, Minneapolis, Minn.

Prominent Mines of Junin, Peru

By Joseph E. Singewald* and Benjamin LeRoy Miller†

SYNOPSIS—A description of three ore deposits of unusual interest. One contains vanadium, another bismuth, and the third, silver. All occur in the western part of the Department of Junin, Peru. The silver and bismuth deposits are near the Cerro de Pasco smelteries, and the Minasragra vanadium deposit is about 18 mi. west of them.

The Minasragra vanadium deposit lies about 18 mi. by trail to the west of the Hauraucaca smeltery. It had been located several times for coal, but was abandoned each time on account of the high sulphur content. In November, 1905, a party of Indians searching for coal brought samples of the material to Antenor Rizo Patron, manager of the Hauraucaca smeltery, who had them analyzed and found that they contained a large percentage of vanadium. The deposit was at once denounced again by E. E. Fernandini, the owner of the smeltery, and Mr. Patron. It happened that D. Foster Hewett was making an examination of vanadium deposits near Yauli for the American Vanadium Co. at the time of the discovery of the vanadium content of this deposit, and consequently visited it. As a result of his investigations the property was purchased by the American Vanadium Co., and since its discovery has supplied about 80% of the world's demand for vanadium. Whereas before its discovery it was something of a problem to meet the demands for vanadium, so remarkable is the richness and size of this deposit that it can be worked only on a relatively small scale in order not to overstock the vanadium market. Mr. Hewett later made other visits to the property, and it is to his careful observations and thorough investigations of the ores, together with determinations of their chemical character by Dr. W. F. Hillebrand, that we owe most of our knowledge of this occurrence. Mr. Hewett's account of it is published in the "Transactions of the American Institute of Mining Engineers" for 1909. Since his last visit considerable work has been done, and at the time of our visit, in the latter part of 1915, it was possible to make a number of observations that lead to conclusions somewhat at variance with those of Mr. Hewett, which will be set forth in this paper.

The trip to Minasragra must be made on muleback from Hauraucaca and requires between 5 and 6 hr., yet it is a trip replete with interest. The first half is across typical rolling pampa lying at an elevation of about 14,000 ft. An occasional llama train is passed bringing in loads of vanadium ore to the railroad or coal to the smeltery or going out to the mines with supplies. At the end of the first hour's ride, one comes in sight of the wonderful "Rock Forest," which lies about 2 mi. to the south of the trail and concerning which one hears so much at Cerro de Pasco. It is an extensive area in which differential erosion has carved the rocks into all sorts of imposing and fantastic shapes and figures that in their variety and number make our famous "Garden of the Gods" appear insignificant. A visit to this place is one of the favorite picnics of the American colony at Cerro de Pasco, and if it were accessible to tourists it would unquestionably be hailed as one of the world's wonders. A short distance farther on one fords the Rio Blanco, on the west side of which the pampa loses its characteristic flatness and becomes somewhat rougher. Much of this part of the trip is along the shores of Lake Punrun, across which is a magnificent range of limestone mountains with the eastern slope so steep as to be practically an escarpment. Quisque is an hacienda, or ranch, belonging to Mr. Fernandini, situated at the foot of the range to the south of the lake. Just before coming to it one crosses a broad, flat valley that slopes down to the lake, and begins the ascent of an outlying knoll amid rough projecting ledges and crags of limestone, and then suddenly finds directly in front of him a most delightful little farmhouse of Spanish style. While resting here a few minutes, we were brought fresh milk by the Indian boys, a kind of liquid refreshment that is rarely served in the high regions of the Andes. Shortly after leaving Quisque, the trail passes through a narrow gorge transverse to the mountains and on the other side comes into the much rougher country in which the vana-

FIG. 1. VIEW OF LAKE PUNRUN, LIMESTONE MOUNTAINS IN THE BACKGROUND

FIG. 3. A VIEW OF THE COUNTRY NORTH OF MINASRAGRA, JUNIN, PERU

*Associate in economic geology, Johns Hopkins University, Baltimore, Md.

†Professor of geology, Lehigh University, South Bethlehem, Penn.

dium deposit is located. There is now an almost continuous ascent to the elevation of 16,500 ft., at which the mine lies. At this altitude living conditions are primitive, both as to house comforts and food. But if one is a lover of nature in its grandest moods, there are compensating features. Overlooking the mine but a short distance to the west is another imposing range of mountains, likewise formed by a thick series of heavy-bedded limestones, which are capped by numerous glaciers and snow fields; while to the north one looks for miles along a broad, flat valley on the slopes of which countless llamas are grazing, with the horizon formed by a distant ice-capped range. The trip to Minasragra would be worth while even if there were no such reward as seeing that unique vanadium deposit.

Geology of the Minasragra Deposit

The general topographic characteristics of the region have already been indicated. The sedimentary rocks are of Mesozoic age and in the area between the two limestone ranges consist of red and green shales with a few thin layers of limestone in the lower part. The ore deposit occurs entirely within red shales in the upper part of the series. These red shales contain abundant gypsum both as intercalated beds and as a network of stringers and veinlets filling joints and cracks in them. In a gypsum bed exposed at the south end of the mine are patches of native sulphur. Outcrops of dikes and irregular masses of igneous rocks are abundant, ranging in composition from quartz porphyry to diabase.

The orebody is a lens-shaped mass having a length of about 300 ft. and a maximum width of 30 ft.; oriented with a strike approximately parallel to that of the inclosing rocks, but with a westerly dip supposedly steeper than that of the shales. It is made up essentially of quisqueite, coke and patronite. Quisqueite is a black lustrous hydrocarbon, coke a dull-black vesicular hydrocarbon, and patronite a greenish-black mineral that is a sulphide of vanadium. Analyses of these minerals given in Hewett's paper are shown in the accompanying table:

MINERAL ANALYSES ACCORDING TO HEWETT

	Patronite, %	Quisqueite, %	Coke, %
Sulphur, soluble in CS_2	4.50	15.44	0.64
Sulphur, combined	54.29	31.17	5.36
Carbon	3.47	42.81	86.63
Hydrogen	....	0.91	0.25
Nitrogen	....	0.47	0.51
Oxygen, by difference	....	5.39	4.64
Water, at 105°	1.90	3.01	None
Ash	....	0.80	1.97
Vanadium	19.53		
Iron	2.92		
Nickel	1.87		
Silica	6.88		
Titanic oxide	1.53		
Alumina (phosphoric acid)	2.00		

Also small amounts of ferric oxide, manganese chromic oxide and alumina.

Small pockets and nests of pyrite are locally abundant, and of interest is the occurrence of a small quantity of a reddish-yellow nickeliferous sulphide of iron to which the name bravoite has been given by Hillebrand. The patronite at the surface has undergone oxidation, and the vanadium close to the surface occurs in the form of hydrated oxides, of which there appear to be a red variety and a brown variety. At a depth of a few feet these give way to a greenish-black oxidation product.

A quartz-porphyry dike cutting across the shales has its outcrop shifted at the ore deposit as if it had been faulted, and Hewett regards the orebody as having been intruded along this fault plane, or fault zone, in a plastic or even liquid condition. as a mass that was probably homogeneous; and that from it the minerals forming it now segregated in a sequence which he determined from a study of polished sections to be quisqueite, coke, patronite. In the hanging wall he thinks there has been some penetration of the patronite into the shales, saying, "Patronite appears to have had the peculiar property, under the conditions of temperature and pressure that existed at the time of the intrusion of the mass, of being able to permeate the porous country rock, even to the degree of saturating it." Replacement of the shales he thinks has taken place only through vanadium solutions formed by the oxidation of the patronite and says, "In some places the solutions have almost entirely replaced portions of the shales, and at other places the vanadium minerals have been precipitated in the cracks and open spaces in the crushed zone."

No positive evidence was seen to indicate that the orebody represents such an intrusion into a definite fault, but rather that it represents a replacement of the shales along a zone of crushing. At the south end of the mine, in a cut made to tram out waste, beyond the limits of workable ore, there is a distinct replacement of certain of the shale layers, which diminishes in amount with increasing distance from the rich ore. A 3-ft. bed of gypsum intercalated in the shale here has not succumbed to replacement. The ore is in the oxidized state and hence may represent replacement by oxidized vanadium solutions in the manner described by Hewett. Better evidence is obtained underground. In the lowest tunnel, 120 ft. below the surface, one can pass from shale to ore through various stages of replacement; and even where the shale is completely gone, the fact that the ore is now found where shale originally existed is unmistakably shown by the complete preservation in much of it of the network of gypsum stringers so characteristic of the shale. Where the mineralizing action has been most intense, the gypsum stringers have been removed and the evidence of replacement destroyed. In the underground workings several gypsum beds are encountered, and even where the overlying and underlying shale is completely replaced by ore, they have persisted, but little affected by the mineralization. A few cases were seen where the gypsum has yielded to a slight extent and contains narrow lenses and stringers of ore. These observations indicate that the gypsum could not entirely resist the mineralization; and it is not surprising, therefore, that the network of narrow gypsum stringers has been removed in a large part of the main mass of the ore.

The faulted quartz-porphyry dike described by Hewitt is the high ledge in the left background of the opencut shown in Fig. 4 and the ridge projecting from the center of the pit to the left of it. According to his view the fault that located the intrusion of the orebody occurred subsequently to the intrusion of this dike. Doubtless, when work first began here, the shift in the dike seemed to be due to a clean-cut fault, but as exposed now in the opencut, it is practically impossible to decide whether the dike was intruded into a curved fissure or whether there was a later movement in the zone of crushing that caused an offset along its strike. Underground the offset is less pronounced than at the surface. Certain it is that there has been no well-defined faulting subsequent to the intrusion of the dike, but at most a slight movement in the shear zone in which the orebody is localized. Then again it appears probable that the dike is later than

the ore deposition. Its top has a westerly pitch so that although it outcrops at the surface on the east side of the mine, on the west side it lies some distance below the surface. Furthermore, the ore lies directly on top of the dike and at the contact has the appearance of having been baked or metamorphosed by it, and the orebody comes up to the dike on either side without increase or decrease in width. Another feature of note is that the dike has not been affected by the mineralizers. In other words, if the dike was present when the mineralization took place, the mineralizers were wholly unaffected by its presence—they did not spread at the contact nor did they diminish in quantity or activity there; yet they had no effect upon the dike itself and flowed out over its top, removing all the shale resting on it. It is true that a similar phenomenon is presented by the gypsum beds, but gypsum is a chemical compound of an entirely different

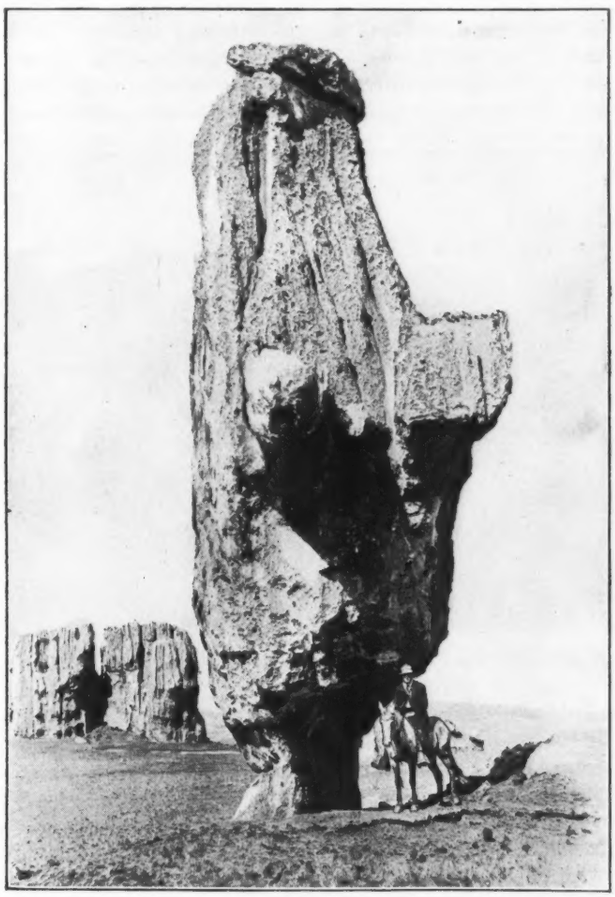


FIG. 2. A TYPICAL VIEW IN THE ROCK FOREST, PERU

nature, and it is conceivable that mineralizers capable of replacing the chemical constituents of shale might not be able to remove gypsum. But chemically, the quartz porphyry is similar to the shale, or at least similar enough to make it difficult to see how such widespread complete replacement of the shale could have been effected and the dike have escaped completely. The weight of evidence now available, therefore, would indicate that the dike is an intrusive across the ore deposit and deflected in that zone of crushing either at the time of its intrusion or by a small later movement.

As to the nature of the mineralizers there is little that one can say, since the deposit stands in a class by itself. Not even in its vicinity has careful search revealed another deposit like it. That they were of a peculiar nature is evidenced not only by the chemical composition of the ores, but also by the fact that they acted so vigorously on the shales and produced so little effect on an otherwise comparatively easily soluble substance as gypsum. Hewett regards the deposit as an extreme phase of differentiation from asphaltite under the stimulus of the igneous intrusions. But whether such a view is consistent with the new interpretation of the localization herein set forth is questionable.

When the mine was first opened, the oxidized ores were worked in the opencut on the outcrop, and the merchantable ore carried about 20% V_2O_5. Later, attention was directed to the sulphides at greater depth and a roasting plant erected in the valley below the mine, and now the entire output comes from the sulphide ores. A tram track from the roasting plant enters an adit that cuts the deposit 120 ft. below the surface and is connected with the opencut by a raise and ore chutes, so that the ore mined in it is taken out through the adit.

In 1909 the roasting plant was built to burn out the sulphur and increase the vanadium content of the marketable material. This plant consists of four hand-operated, double-tier reverberatory furnaces, with a capacity of about 80 tons. The ore to be roasted is fed at one end of the upper tier and slowly worked over to the other end, where it drops to the lower and is worked in the same way to the discharge end. The time consumed in passing through the furnace is two days. At the temperature of the furnace it is self-burning until all but 3% of the sulphur is expelled, when coal must be added to reduce this to ½%. The fuel used is a semianthracite packed on llamas from some small coal deposits in the region. The roasted ore carries 50% V_2O_5. The quisqueite is not removed in this roasting and is still present in the roasted product.

The San Gregorio Bismuth Mine

The San Gregorio bismuth mine is the property of E. E. Fernandini, the owner of the Hauraucaca smeltery, and is situated about a mile to the southeast of that smeltery on the west side of the Cerro de Pasco railroad and three miles south of Fundicion, the Cerro de Pasco smeltery. It is near the base of a small knoll that rises above the pampa to an elevation of about 150 ft. The hill consists of sandstone that varies in texture from quartzitic to saccharoidal, and it is in a brecciated mass of this rock that the ore deposit is found.

The ore consists entirely of oxidized bismuth compounds and is said to be principally the arsenate. It occurs together with a yellow-to-brown colored clay as a matrix of the brecciated sandstone. In places it fills the interstices between the sandstone fragments in the form of the light-yellow bismuth compounds, but more generally it impregnates the yellow and brown clays that make up most of the matrix. The crude ore averages about 3% bismuth. The deposit has been worked in an opencut with a length of 1,000 ft. and a width of 80 ft. At a depth of 20 to 30 ft. below the surface, the bismuth content is said to become very low, and as yet no sulphobismuthides or corresponding bismuth minerals have been encountered of which the deposit may represent the gossan. It is not at all clear whether the ores were deposited in their present condition, or whether they represent the oxidized rem-

nant of primary minerals of a different character; or, if the former is the case, whether they were deposited by ascending or by descending solutions. Consequently the source of the bismuth cannot be explained. All that can be said is that the ore has been localized in the shattered brecciated portion of the sandstone.

As is well known, the world's bismuth market is controlled by a rigorous trust, which assigns to each producer the amount of bismuth that he may furnish. The San Gregorio mine is a party to this agreement, so that its actual production is no criterion of its potentiality as a producer. The tonnage in sight is sufficient to supply the world's demand for bismuth for many years, and it could be produced profitably at 30c. per lb., whereas the average price is $2. The annual mine production of bismuth is a little over 300 tons, and of this the San Gregorio mine is allotted 25 tons. The mine has been in operation about ten years, and during this time the ores have been concentrated in a mill at the Hauraucaca smeltery to yield 20% concentrates, which have been the marketed product. At the same time, a pile of 10,000 tons of middlings averaging 5% bismuth has accumulated, which is now being treated by lixiviation. The material is first roasted and lixiviated with sodium chloride and sulphuric acid. Bismuth sulphide is precipitated from this solution by adding sodium sulphide, and from it native bismuth is recovered by smelting. Mining operations have been suspended, and the entire allotment of bismuth is being obtained by the treatment of these middlings, which are ample to last for a number of years. The Colquijirca silver mine is on the eastern slope of the hill on the opposite side of which, and about 1½ mi. to the southwest, is La Fundicion, the Cerro de Pasco smeltery. The mine is owned and operated by E. E. Fernandini. The daily output at the present time is 80 tons of ore averaging 70 oz. Ag per ton. The lowest grade that can be profitably worked is about 50 oz. Ag. The ore is treated at Fernandini's Hauraucaca smeltery, by concentration and smelting.

The country consists of a series of limestones underlain by shales in which are intercalated beds of coarse and fine conglomerates with a shaly matrix. Within the limestone series itself are impure shaly beds and beds of sandstone of very local occurrence. The formations have a north-south strike and a general easterly dip which has been modified by two minor synclines.

The ore deposit consists of two beds of ore intercalated in the limestone series, which represent replacements of the limestone, and they are separated by a parting of variable thickness but averaging a little more than 2 in. Owing to the folding, the ore horizons outcrop at four points across the section. These outcrops are marked by a series of trenches on the hillside resulting from the extraction of the gossan ores in years gone by. Similar replacements, but on a smaller scale and not resulting in workable ores, have been encountered at lower horizons by the crosscut tunnel. Orebodies such as these with considerable horizontal extent are called *mantos*, which is the Spanish for "mantle" or "covering."

The limestone has been replaced chiefly by black, chert-looking silica and by pyrite. In some places the *manto* consists almost wholly of the chert, at others almost entirely of pyrite, and then again both minerals are present in abundance. Associated with these minerals, in subordinate amount but in sufficient abundance to be a prominent constituent of the ore, are galena and barite, and the amount of silver the ores carry seems to be closely related to the quantity of these minerals present. The smaller *mantos* referred to in the foot wall consist almost entirely of pyrite and are unworkable on account of their meager silver content. On the other hand, the quantity of galena and barite is not an invariable indication of the quantity of silver the ore carries. It is found that when these minerals are coarsely crystallized, there is less silver than when they occur in smaller crystals, a difference that is especially marked in the case of the galena. The barite in particular occurs in druses and small cavities as a network of interpenetrating tabular crystals, and it and the galena to a less extent have the appearance of hving been introduced later than most of the silica and the pyrite. Associated with the minerals already mentioned, especially in the south end of the mine, a little chalcopyrite is encountered here and there. In the richest ores a little tetrahedrite and probably other "sulphurets" can be recognized.

FIG. 4. THE MINASRAGRA VANADIUM MINE, JUNIN, PERU

The mine is remarkable for the magnificent specimens of native silver in the form of coils and clusters of wire silver that is affords. The oxidized zone is not now accessible, but in the sulphide zone there are local areas that have been subjected to the action of oxidation, usually along some zone of disturbance and fracturing, and in these the partly oxidized ores frequently abound in the native silver. Its most common habitat is in the spaces between the interlocking tabular crystals of barite, where it may be found alone or adhering to some of the sulphides, very commonly to the tetrahedrite or other "sulphurets." We are indebted to the kindness of Julio N. Arce, the manager of the mine, for several really wonderfully specimens of this kind.

The mine is developed by means of a tunnel over 1 km. in length and a shaft from the surface which meets the tunnel about 700 m. from the portal, as shown on the cross-section. Mining is now confined to the portion

of the orebody below the tunnel level, and the ores are taken out through the tunnel level. Drifts have been run along the strike of the *mantos,* 350 m. to the north and 300 m. to the south, without reaching their limits. From these drifts, close to the tunnel, three inclines 60 and 10 m. apart have been sunk on the *mantos* with a length of 90 m. and levels at each 30 m. The dip of the ore beds in these workings ranges from 35° to 25°. Most of the output comes from this part of the mine, where there is a rich oreshoot averaging over 100 oz. Ag per ton. The *mantos* here have a thickness of 12 m. including a parting of 2 m., and the entire thickness is removed by square-set mining. Adjoining this oreshoot on the south and continuous with it is ore of the same appearance that carries only 5 to 10 oz. Ag per ton and is hence unworkable. This is a striking example of the extreme variation in the silver content of the ores, so that although the *mantos* are continuous throughout the extent of the mine, they consist of workable ore in restricted areas only.

The mine is equipped with modern, electrically driven machinery and has about it an appearance of efficiency that is not commonly seen in the small, locally owned mines of South America.

Anaconda Begins Production of Electrolytic Zinc

BUTTE CORRESPONDENCE

The first section of five, composing the new zinc refinery of the Anaconda Copper Mining Co., at Great Falls, Mont., was placed in operation on Monday morning, Sept. 11. The 144 electrolytic tanks were filled by 2 o'clock in the afternoon and 1,200 amp. turned on at the new substation. Late Monday afternoon one of the cathodes was taken out and the zinc peeled off the aluminum plate. It was a sheet as thin as paper, but was eagerly prized as souvenirs by scores of officers and employees of the company who had watched the starting of the big plant.

ENTIRE PLANT WILL BE IN OPERATION BY NOVEMBER

Wednesday afternoon the first stripping of the plates netted 25 tons of zinc that was sent to furnaces at Anaconda for transforming into the commercial article. The two new 50-ton furnaces that are to handle the output at Great Falls are being constructed and will be ready for operation about the first of October. By that time it is also expected that two additional units will be operating at the refinery and by Nov. 1 the entire plant with a capacity of 5,000,000 to 6,000,000 lb. of high-grade zinc per month will be in operation.

The first week's trial of the new plant has proved most satisfactory. Frederick Laist, head of the metallurgical department of the Anaconda company, who devised many of the leading features of the new zinc process, as well as many of the other leading officers of the company, spent the week in Great Falls watching the starting of the new refinery.

The zinc is brought in concentrates from the new concentrator at Anaconda. On arrival at Great Falls, it is taken first to the roaster, where it is changed into calcines. This fine powder carries, in addition to zinc, copper, lead, silver and gold. It is next distributed to leaching tanks having a depth of 20 ft. and a diameter of 10 ft. In these it is agitated in acid solution by compressed air forced in from below. After agitation the pulp passes into Dorr thickeners where the lighter solution containing most of the zinc is drawn off and filtered, the pregnant solution being pumped into storage tanks in the refinery proper and sent from there to the electrolytic tanks. These are arranged end to end with six tanks in each battery, the solution cascading from tank to tank. Each tank is 5 ft. long, 3 ft. wide and 3 ft. deep and contains 28 lead anodes and 27 cathodes consisting of aluminum plates upon which the zinc forms and is later stripped off and sent to furnaces for casting into commercial forms. The zinc is 99.9% pure.

Ground for the new plant was broken on Jan. 1 of this year and close to $3,000,000 has been expended in the construction and equipment of this zinc department of the Anaconda company. The aluminum cathodes for the electrolytic tanks alone represent an investment of nearly half a million dollars. Each one has 14 lb. of aluminum and 16 lb. of copper, and there are 20,000 of these in the five sections of the new plant. The copper metal for each cathode is worth between $4 and $5. In addition there is the expense of manufacture.

The new substation that furnishes the electricity for the zinc plant is completed, and three of the five rotary transformers are in place. The plant will use 33,000 hp. when it is operating at capacity. All this power will come from the Rainbow and Big Falls plants of the Montana Power Co., situated within 10 mi. of the new refinery.

The concentrator at Anaconda is completed, and there will be no lack of zinc concentrates for the new refinery as soon as the additional units are put into operation. By Nov. 1 it is estimated that fully 2,000 tons of zinc ores per day will be used for this new department. The ores will come from the Emma, Poulin, Alice, Lexington and other Butte mines of the Anaconda company, and from the Douglas mine in the Pine Creek section of the Coeur d'Alene district in Idaho, which is under option to Anaconda.

Chinese Mineral Exports Grow

Statistics relating to exports of Chinese mineral products, given by *United States Commerce Reports,* show impressive gains in 1915 over the previous year. Those relating to antimony, pig iron, tin and zinc record large gains, particularly in the value of exports, since the start of the great war, as shown in the following tabulation:

CHINESE MINERAL EXPORTS, 1914-15

	Quantity		Value		Value of U. S. Imports,	
Mineral	1914	1915	1914	1915	1914	1915
Antimony:						
Regulus, tons ..	21,648	25,746	$929,565	$2,873,809	$227,331	$822,537
Ore, tons	5,479	1,343	104,097	81,954	102,820	208,094
Iron:						
Pig, tons	66,084	106,412	862,384	1,519,271	.....	.....
Ore, tons	330,065	340,579	446,277	427,254	.....	.....
Lead, tons	259	757	11,773	40,119	.....	.....
Lead ore, tons....	4,102	63	141,030	1,670	.....	.....
Quicksilver, lb. ...	131,467	464,533	69,869	384,464	.....	.....
Tin, in slabs, tons.	7,948	8,825	5,345,634	5,659,049	.....	.....
Zinc:						
Ore, tons	8,126	9,415	57,218	78,029	31,375	37,474
Spelter, tons ...	342	2,568	21,449	269,976	.....	.....
All other, tons...	2,175	9,872	224,887	1,065,329	.....	.....

Of these exports the United States absorbed antimony and zinc invoiced at the values shown in the last column.

Asbestos Production in the Ural District in Russia is given by a British consular report at 8,689 metric tons in 1915. This was only about half the output of the preceding year.

Details of Practical Mining

Safety Rules for Loggers

The following rules and suggestion from the September, 1916, issue of the *Anode* should be of more than passing interest to those mining companies operating in comparatively virgin territory where a large portion of the timber requirements are filled by loggers employed by the company. These are usually working on a contract basis and for this reason are not under very close supervision, their chief requirement being to turn out a product. However, in case of accident they have to be treated at the company hospital and incur added expense due to their carelessness. In many mining camps the loggers are known for their carelessness and recklessness. Their attention should be called to these rules and their observation enforced by the contractor for his own benefit as well as that of the company and men.

Do not stand or work in the bight of any line.

Do not stand or work close enough to any block so that in case the line breaks the end could possibly whip around and hit you.

Do not stand upon or ride any logs as they are being hauled in by the engine, or in front of them.

Do not stand in front of a log or on the downhill side of a log after the engineer has been given the signal to go ahead.

Do not give the signal to go ahead until you are sure that every man is well out of the way and clear of all limbs.

Carefully inspect, look out for and guard against all falling of dry snags or the tops of trees, when logs come in contact with them as they are being hauled to the landing.

When oiling blocks, do not go near the line or blocks when the engine is in motion.

Gasoline Motors in Tunnels

In the Wilson Avenue water tunnel, Chicago, which totaled about 45,000 ft. of length in various sections, gasoline locomotives were used satisfactorily, according to H. W. Clausen in the *Journal* of the Western Society of Engineers, May, 1916.

After the drifts had been advanced to where mule hauling became slow and expensive, gasoline locomotives were installed. They were of the four-wheeled type, driven by 40-hp. four-cycle engines running at 800 r.p.m. The locomotives weighed five tons each, attained a speed of 8 mi. per hr. and at that speed developed a drawbar pull of 900 lb. They usually pulled trains of 20 to 25 loaded cars, and in an emergency as many as 57 loaded cars were pulled out of the drift. The exhaust gases thrown off by the internal-combustion engines were passed through a water-box, which removed the smoke and unburned gasoline. The small quantity of CO and CO_2 remaining was ordinarily sufficiently diluted to be unobjectionable.

Gasoline locomotives have been used in other tunnels with unsatisfactory results, but this appears to be due to mechanical defects of construction. These locomotives were supplied by the Baldwin Locomotive Works at a cost of $3,100 each and proved entirely satisfactory in operation.

Shaft-Timbering Examples

By Albert E. Hall*

After the method of sinking a shaft has been decided and all the troublesome problems that arise concerning details have been satisfactorily solved, there remains the question of timbering. The timbering of course depends

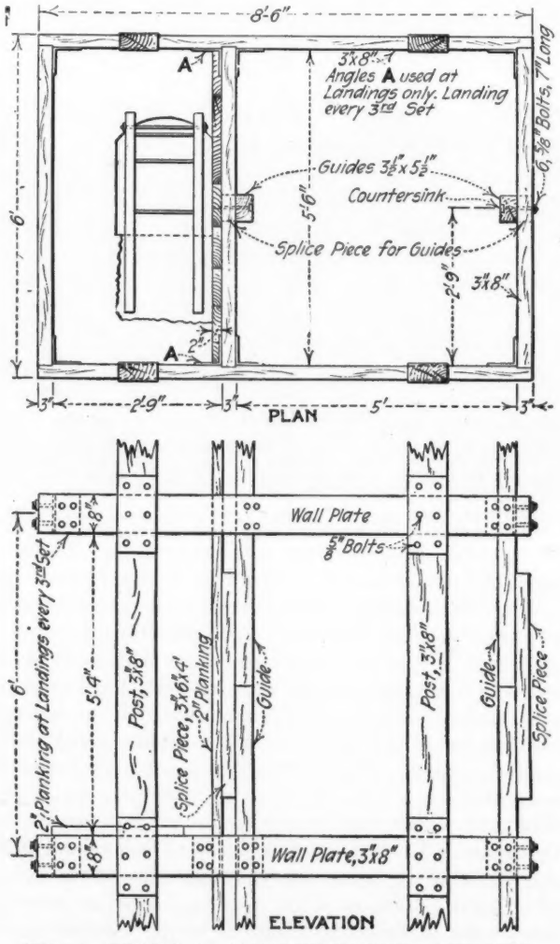


FIG. 1. WINZE AT CREIGHTON MINE, ONTARIO

among other things upon the nature of the ground, but probably the next consideration is the use to which the shaft is to be put, the demands that are to be made upon it and the life that is to be expected from it. We would not expect to find a prospect shaft or a winze as heavily

*Superintendent, Sable River Copper Co., Massey, Ont.

timbered as the main shaft of a mine with a large output. The first example shows some substantial timbering that is fairly light and yet serves well for a prospect shaft or winze.

The shaft in question, shown in Fig. 1, was sunk as a winze from one level to the next lower, and a drift was run from its bottom to the point where the main shaft was raised. This winze handled all the muck from the shaft, and also from the crosscutting and drifting until the main shaft was completed. The inside dimensions of the winze were 8x5½ ft. There were two compartments, one serving as a ladderway and the other for the cage, which accommodated a one-ton car. All the timber in the winze was 3x8 in., which was easy to handle, quickly framed and stood up well. The total depth was 100 ft., and the sets were placed on 6-ft. centers. The wall and end plates were held together with heavy angles, which were bolted to the timbers. The divider was also secured with angle irons. Four posts were employed, which, instead of being placed at the corners, were set in a little way. Between the cage and ladderways was planking, while a staging of 2-in. planking was put in about every third set in the ladderway. The guides for the cage were 3½x5½ dressed and were put in in 24-ft. lengths. Splice pieces made of 3x6 were used at the joints and were about 4 ft. long. This winze was sunk at Creighton mine, Ont., Canada.

In contrast to the light timbering of the foregoing example is that of No. 2 shaft of the Dome mine, South Porcupine, Ont. This is a three-compartment shaft having two skipways and one combined ladder and pipe compartment. As originally designed, the ladder and pipes were intended to be in separate compartments, but later this was deemed inadvisable. The inside dimensions are 6x18 ft., and the sets are spaced on 6-ft. centers with a bearer set under every seventeenth regular set. Instead of using one size of timber throughout the set, it was varied to the work it had to do. The wall plates, end plates and corner posts were made all of 8x8 in., while the dividers and divider posts were made only 6x8 in. The shaft was lagged with planking. The sides of the ladder are 2x4 in. spaced 16 in. apart. These are held together by bolts, and between bolts are six rungs made of ⅔-in. pipe set ¾ in. in the sides. The rungs are spaced on 11-in. centers. Where traffic is heavy on the ladders, steel rungs would probably prove superior to pipe, as the latter would wear through in a short time.

The third shaft now described has to meet greater demands than either of the others. This is the "D" shaft of the Newport Mining Co., at Ironwood, Mich., a five-compartment shaft inclined at 68°. One compartment accommodates the pipes and ladder, while two of the others are used as skipways all the time and the remaining two sometimes as skipways and sometimes as cageways, according as the circumstances demand. The skips are run in balance usually, and of each pair one comes to the surface in about 1 min. 40 sec. from the 2,300-ft. level (inclined distance). The sets consist of steel members which in the upper part of the shaft are set on 6-ft. centers, and in the lower part on 4-ft. centers. For bearers, heavy I-beams are used. Both wall plates are sections 5x4¾ in. at 24.1-lb., while the dividers are 4x4 at 13.6-lb. H-sections. The wall plates are spliced, which necessitates one divider being cut shorter than the other. The end plates are the same size as the dividers. For studdles 3x3 at 4.9-lb. angle irons are used. The shaft is lagged with peeled cedar. The skips run on 40-lb. rails fastened to the foot-wall plates. Back runners are also employed. These are 6x8 in. and are held in place both by bolts and by angles. The whole shaft inside is

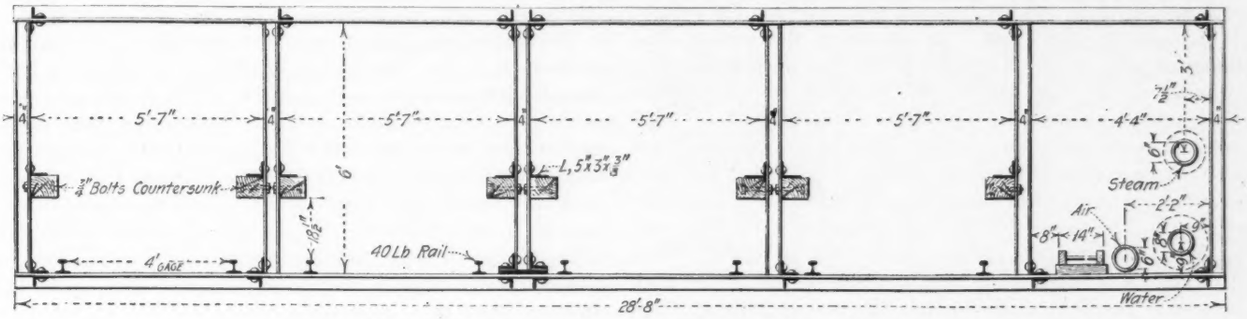
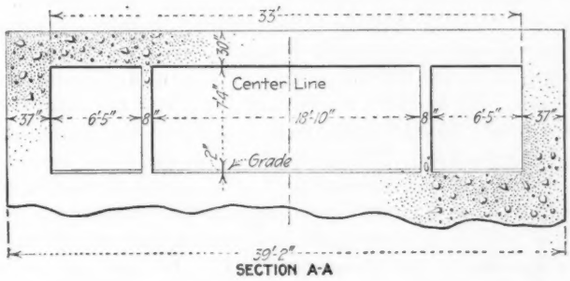
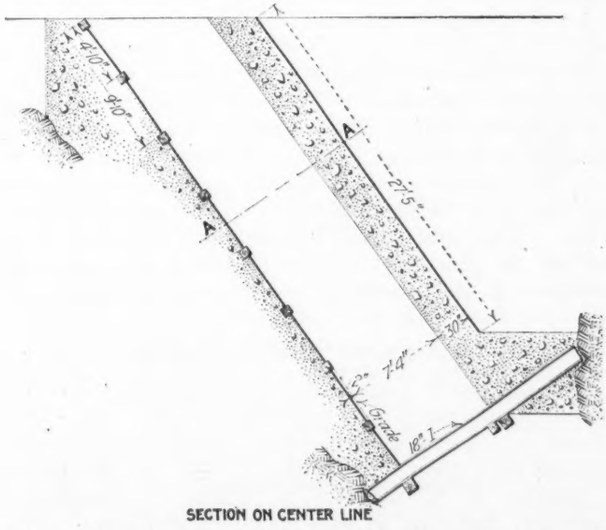


FIG. 2. SHAFT OF NEWPORT MINING CO., IRONWOOD, MICH.



SECTION A-A



SECTION ON CENTER LINE

FIG. 3. INCLINED SHAFT AT CREIGHTON MINE, ONTARIO

28x6 ft. The skip compartments are 5 ft. 7 in., while the ladderway is 4 ft. 4 in. wide. The plan of the shaft is shown in Fig. 2.

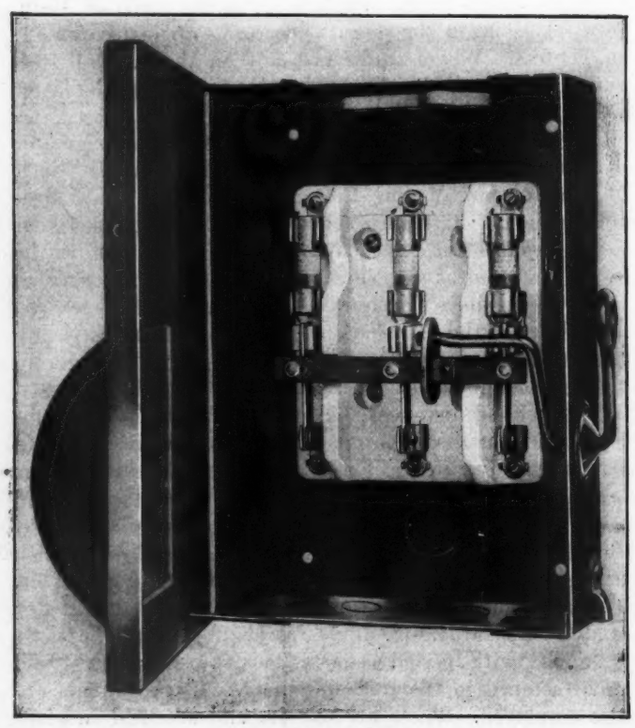
The fourth and last example of shaft building is found in a new shaft being sunk at the Creighton mine, Ont., known as No. 3 shaft. This is still being sunk, and the timbering has not as yet been fully designed. The concrete collar, however, is finished and is shown in Fig. 3. This collar is strongly reinforced, and at the bottom four heavy 18-in. I-beams are placed. This shaft is 33x7½ ft. inside. The foot-wall plates in the collar are 10x10 in. and are set 2 in. above the concrete, making the height 7 ft. 4 in. in the clear. As shown in the section, the hanging-wall part of the collar at the bottom has not been completed, but this will be put in when the permanent timber is being placed. The shaft is inclined at 55° and has five compartments. In the collar at present there are only three compartments, as shown in Fig. 3. The two end compartments are complete, one being used as a ladderway. The three middle compartments have been left as one, and the two sinking skips run in these. Two division walls of concrete are in place in the collar, and provision has been made so that the two remaining division walls can be put in place when sinking is finished. Below the collar temporary 10x10-in. wall plates have been put in every 10 ft., and the rails are spiked to these. No other timbering has been done except at a few points where loose ground had to be supported.

A Practical Safety Switch

By W. D. Lindsey*

Each year one hears of accidents resulting from the use of the open switch, and often such accidents go unrecorded; but were it possible to make an accurate accounting, the total would probably be surprisingly great.

*Western Electric Co., 195 Broadway, New York City.



A SAFETY SWITCH

An open-switch accident may mean death from shock to a workman and the resultant demoralization of others. Or a switch may be thrown while a repair man is working on shut-down machines. Fires resulting in loss of lives and property are often caused by short-circuit from the open switch.

The "Square D" inclosed switch, which is manufactured by the Western Electric Co., is offered as a remedy for the open-switch evil. Its development has been carried out in accordance with the principles of the safety-first movement in the standardization of electrical equipment.

The switch and cutout unit are completely inclosed in a metal box provided with a hinged cover which is held closed with a simple spring catch. The switch is operated by a crank handle located outside the box. The switch may be locked in the "off" position to prevent accident when repairs are in progress. Means are provided to lock or seal the cover shut to prevent unauthorized persons overfusing the switch or tampering with live connections. These switches are also provided with a label issued by the Underwriters Laboratories, Inc., indicating that they have been examined and tested with the object of classing them as safety apparatus. They have also been approved by the Federal Bureau of Standards and the Workmen's Compensation Service Bureau.

The pressed-steel switch is made for all commercial voltages from 125 to 600, and in capacities of from 30 to 600 amp. All switches for 60 amp. and over are equipped with a quick "break" attachment to prevent the formation of dangerous arcs. The ends of the pressed-steel box are removable and can be equipped with plates for suitable knockouts to fit any wiring condition. The plunger switch has the switch gear inclosed in a cast-metal casing, and as in the case of the pressed-steel type, the mechanism is operated from the outside of the box. The switch mechanism is of the quick make-and-break type, and when closed a gasket in the lid makes the box fire, water and fume proof, so that installations may be made where water, fumes and dust exist without injury to the working parts of the switch. These switches are so constructed that the covers cannot be removed when the switch is in the "on" position; neither can the covers be closed after opening until the mechanism is brought to the "off" positions. This arrangement has been worked out so as to obviate the possibility of short-circuits in dangerous atmosphere in the process of operating the switches.

Tunnel Backsight

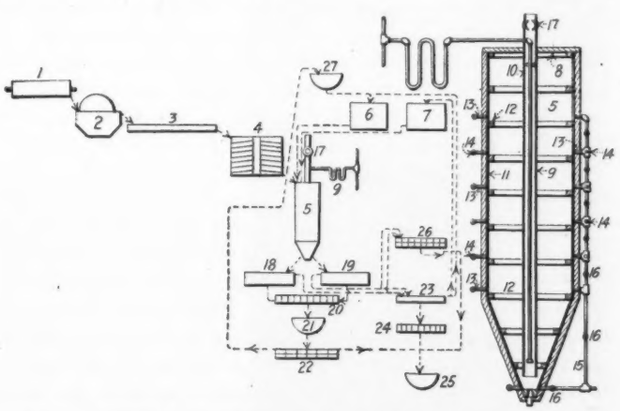
For driving a long tunnel to connect with existing workings alignment is of prime importance. The portal of the tunnel having been chosen and the transit set up and sighted upon a determined point over the tunnel alignment, it is necessary to establish a permanent backsight that can be used during the driving. This should be at a considerable distance and on the same grade as the tunnel. The telescope is reversed and set at the negative grade of the proposed tunnel. The ground contained in the vision of the telescope is then sought and a backsight established. It may be several miles off, but that is only the better. A wooden board 4 ft. square divided into four squares painted diagonally white and black and firmly fixed will give a good backsight that is easily picked up and from which it is easy to keep the tunnel alignment.

Details of Milling and Smelting

Lixiviation of Lead and Zinc

A new method of treating complex ores of lead, zinc, iron, silver and copper has been devised by R. S. Handy, of Kellogg, Idaho, and granted U. S. Patent No. 1,185,902. The ore is first ground to pass a 20-mesh screen in the apparatus diagrammatically indicated at 1 in the drawing. After having its surplus moisture removed by the filter 2 and the drier 3, the ore is roasted in the cylindrical roaster 4. Here an ore of the composition indicated is roasted to form as much lead sulphate and ferric oxide as possible. This roasted ore then passes into the filtering tank 5.

The tank is tightly covered and contains an air lift centrally suspended and equipped with discharge holes near the top of the tank. The inside of the tank is covered by a suitable filtering medium 11 secured by circular wooden strips fastened to the tank. These wooden strips form compartments, each of which is drained by suitable pipes leading to a surrounding



FLOW SHEET OF PROCESS AND SECTION OF FILTER TANK

header. The headers are all connected by the pipe 15 leading to a suction pump not shown. By means of valves 16 the compartments may be consecutively shut off from suction, an arrangement which facilitates draining of the filter tank according to the specific gravities of the contained fluids, when desirable. The valve 17 at the head of the air-lift pipe may be closed at any time and pressure used for filtering instead of suction.

The roasted ore introduced into this tank is subjected to the leaching action of hot sodium chloride, ammonium chloride or ferrous and ferric chloride, as desired, these solutions being supplied from the storage tanks 6 and 7. Both agitation and aëration are effected by the air lift, after which the pregnant solutions are filtered out into the settling tanks 18 and 19.

When the roasted ore is first subjected to the leaching action of hot sodium chloride, the lead sulphate is dissolved and sodium sulphate formed according to the reaction $PbSO_4 + 2NaCl = PbCl_2 + NaSO_4$, but the ferric oxide and remaining sulphides are not attacked. Arrived in the settling tanks the lead chloride crystallizes out of solution when cool, and the $NaSO_4$ solution is decanted off. The lead chloride is then first filtered in press 20, evaporated in 21 and the dried and fused product separated into metallic lead and chlorine in the electrolytic cells 22. This gaseous chlorine is piped to the apparatus 27, where as hydrochloric acid it attacks iron in the ores to form the ferrous or ferric chloride utilized in leaching the residuum in the filter tank after the lead chloride has been leached, this iron chloride product being stored in the supply tank 6.

The residue from the first filtration consists of the sulphides of lead, copper, zinc and silver, which when attacked by the ferric chloride solution in the filter tank form their respective chlorides—ferrous chloride and sulphur. These solutions after reaching the precipitation boxes 23 from the settling tanks 18 and 19 come in contact with metals that precipitate them, iron being used for precipitating both lead and copper, while copper precipitates the silver. Ferrous chloride in each case is the eventual product remaining in solution; and this is rapidly oxidized by the air to ferric chloride, which is returned to the leaching circuit.

The precipitated metals are collected and melted in the filter 24 and pot 25 respectively. The zinc chloride decanted from the solution of the other metals is led into the electrolytic cells 26, where the metal is deposited by the now well-known action of the electric current.

Treating Amalgamation Tailings

By John Allingham*

The tailings resulting from old pan-amalgamation mills have been difficult to treat economically—in fact, it is extremely doubtful whether any profit has been made by a well-known company that has treated many thousands of tons of tailings from the Comstock Lode, Nevada.

The tailings contain a great deal of organic matter, including charcoal. The silver contained is in the form of chloride and sulphide. The mercury exists as a mercurous salt for the most part, although there is some metallic. By careful panning about 1% of clean concentrate is obtained, assaying 52 oz. silver and 1.2 oz. gold per ton. The copper contained is insoluble in water, but 80% can be dissolved by sodium thiosulphate.

Half the mercury existing as a mercurous salt is soluble in sodium cyanide and sodium sulphocyanide with a precipitation of gray mercury.

$$Hg_2Cl_2 + 2\,KCN = Hg(CN)_2 + 2\,KCl + Hg$$

$$Hg_2Cl_2 + 2\,NaCNS = Hg(CNS)_2 + 2\,KCl + Hg$$

The mercury sulphocyanide forms a double salt with the excess of sodium sulphocyanide present. The mercury is precipitated by zinc and iron. In practice silver and gold were precipitated on pump runners and lines, pipe lines and in tube mills. The cement backing to the liners in the tube mills, ground, assayed 6.2 oz. Au and 54 oz.

*Engineer, Hurley, N. M.

Ag per ton. The coarse cement scale assayed 5.2 oz. Au and 20.4 oz. Ag per ton.

Coarse material caught on screens at tube-mill discharges, containing a small amount of concentrate and a grayish precipitate, but principally consisting of coarse sand and pieces of flint pebbles, assayed 1.7 oz. Au and 9.4 oz. Ag per ton. The tailings being treated at this time assayed 0.12 oz. Au and 3.6 oz. Ag per ton.

All iron in contact with pregnant solution showed evidence of precipitation of gold and silver, the gold being more easily precipitated than the silver. The precipitation of silver and gold is caused by the mercury being precipitated on the iron and in turn acting as a precipitant for the gold and silver. Gray mercury also precipitates gold and silver from cyanide solutions, but in practice I do not think the small amount present interfers very much with the extraction of the gold and silver, as any precipitated would be dissolved again. However, with weak cyanide solutions, relatively poor extractions are made in the same time as are made with strong solutions, say 0.04% NaCN and 0.2% NaCN. With a strong solution, treating unground tailings, 48 hr. agitation, a washed residue assaying 0.01 oz. Au and 0.9 oz. Ag is easily obtained; the cyanide consumption is about 0.5 lb. per ton more than when using a weaker solution. It may be that any prematurely precipitated gold and silver would not be dissolved by weak solutions in an ordinary time of treatment.

Effect of Mercuric Chloride on Solutions

As the mill solutions contain sulphocyanides, some double sulphocyanide of mercury is formed. This may explain why the addition of mercuric chloride to working solutions, as an aid to extraction in the treatment of silver ores, is not successful. In my experimental work in Mexico, using freshly prepared solutions, the addition of small quantities of mercuric chloride to the solution at the last 24 hr. of treatment always resulted in a better extraction of the silver, while in practice after the mill had run two months, no beneficial result was observed, and the use of mercuric chloride was discontinued.

As has been stated, the mercury in the tailings is partly soluble in sodium thiosulphate, an average of a number of experiments showing that 55% of the mercury could be dissolved by a 0.1% solution of sodium thiosulphate. The mercury can be precipitated from the solution by means of an alkaline sulphide.

As is well known, when sodium thiosulphate is added slowly to mercury salts, the following reactions take place:

(1) $Hg_2(NO_3)_2 + Na_2S_2O_3 = Hg_2S + Na_2SO_4 + N_2O_5$

(2) $3\,Hg(NO_3)_2 + 2\,Na_2S_2O_3 = 2\,HgS\,.\,Hg(NO_3)_2 + 2\,Na_2SO_4 + 2\,N_2O_5$

(3) $3\,HgCl_2 + 2\,Na_2S_2O_3 + H_2O = HgS.HgCl_2 + 2\,Na_2SO_4 + 4\,HCl$

But when an excess of sodium thiosulphate is added, then the following reactions occur:

(4) $HgCl_2 + Na_2S_2O_3 = HgS_2O_3 + 2\,NaCl$

(5) $Hg(NO_3)_2 + Na_2S_2O_3 = HgS_2O_3 + 2\,NaNO_3$

(6) $Hg_2(NO_3)_2 + Na_2S_2O_3 = HgS_2O_3 + 2\,NaNO_3 + Hg$

(7) $Hg_2Cl_2 + Na_2S_2O_3 = HgS_2O_3 + 2\,NaCl + Hg$

The mercury thiosulphate in each case dissolves in the excess of sodium thiosulphate, forming a double salt.

The time of agitation in the experimental work varied from 2 to 12 hr., 6 hr. being found to be sufficient. The consumption of "hypo" varied from 3 to 4 lb. of commercial salt per ton of tailings treated. In a 1-hr. agitation, 29% of the gold and 23.9% of the silver were dissolved. Certain experiments show that it is possible to obtain extractions of the gold and silver equally as good as those obtained by cyanidation.

There are yet some 350,000 tons of untreated tailings of the class described awaiting some economical treatment. A great deal of experimental flotation work has been done by many on these tailings, and although 85% of the combined value of the gold and silver has been concentrated, the cleaning of the first concentrate appears to be difficult. From some experiments made personally, to obtain a good result it was necessary to make a first concentrate from 12 to 16% by weight of original charge. Before flotation the charge was given a preliminary treatment with sodium sulphide. In cleaning the concentrate, I found that ground charcoal (about 10 lb. per ton of concentrate) agitated thoroughly with the concentrate effectively assisted in the cleaning.

Use of Reinforced Concrete in Metallurgical Work

Reinforced concrete has been widely adopted in construction work, and in recent years especially many new applications have been made of this type of construction. It has been extensively used among metallurgical plants for abutments, foundations for metallurgical machinery forms, flues, tanks, tunnels, working platforms and, to a limited extent, for chimneys and furnace bottoms.

At a number of plants reinforced concrete was used for the hearths of multiple-deck roasters of the MacDougall type. An experimental roaster was built of reinforced concrete at Miami, Ariz., by R. C. Canby, but although it served the purpose for which it was constructed, Mr. Canby writes that its length of service was not sufficient to indicate the endurance of concrete for actual operating duty. Regarding the reinforced-concrete roasting furnaces tried at Anaconda, E. P. Mathewson wrote that they were entirely unsatisfactory. A 25-ft. furnace of the Wedge type was built with three floors made of slag concrete and three of quartz concrete. This furnace was a complete failure and had to be rebuilt of brick. He also reported that the several smaller furnaces of the MacDougall type in Great Falls were giving much trouble and were extremely difficult to repair. No more roasting furnaces of this type are to be erected by the Anaconda company.

There is an impression in metallurgical circles that the Great Falls reinforced-concrete roasters were satisfactory, but this seems to be quite at variance with Mr. Mathewson's opinion and experience. Hence it may be assumed that reinforced concrete has practically no technical importance in the construction of the hearths of mechanical roasting furnaces for an operating duty, though it may be of service, under special conditions, for temporary experiments.

Where failure has occurred in reinforced-concrete flue or smoke-stack construction, it seems to have taken place at that section of the flue or stack where the temperature became sufficiently low to permit condensation and sulphatization of the ingredients of the cement.

Mining & Metallurgical Machinery

The Darnall Siphon Filter

The Darnall filter adopted by the United States Army has three important advantages that make it particularly valuable for use in mining camps, where water supply is rarely above suspicion. It eliminates bacteria; it is simple, light and inexpensive; it delivers drinking water continuously, beginning within eight minutes of setting up.

The average reduction of bacteria in the filtered water is over 99%. This result compares favorably with the best municipal filtering plants. Muddy water is made perfectly clear. No taste is imparted to the water.

The filter is designed to be used in conjunction with a coagulant and is absolutely worthless for purifying drinking water unless so used. Used without previously adding a coagulant, it will remove only the gross impurities such as mud and other coarse particles, leaving the dangerous impurities, bacteria, in the filtered water. The Darnall filter is based upon this principle. Alum is added to the water simultaneously with a sufficient quantity of a carbonate to neutralize it; the water is then filtered. By using the two chemicals (alum and soda) in such proportions as to practically neutralize each other, it is possible to produce a precipitate as heavy as may be desired without depending on the uncertain amount of carbonate of lime in the water.

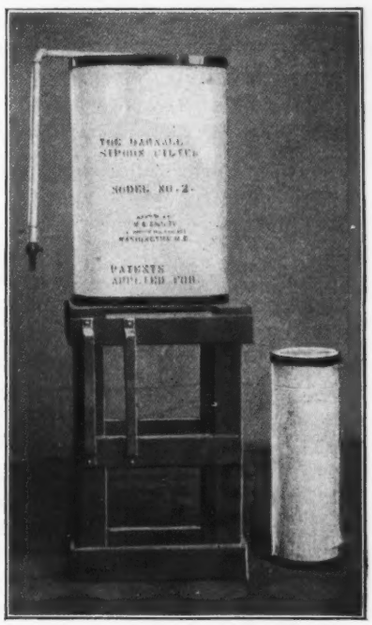


FIG. 1. DARNALL FILTER READY FOR USE

Practically the amount of alum used need never exceed five grains to the gallon of water to be purified. This quantity is sufficient for the foulest and muddiest water. To neutralize this amount of alum, about 2.7 grains of sodium bicarbonate will be required.

The Darnall filter consists of an oval tank 14½x7½x25¼ in., shown in Fig. 1, containing the spool-like form of the filter frame, shown in Fig. 2, upon which are tightly wrapped eight thicknesses of flannel filter-cloth. The coagulating powder is added to the tank and the water filtered by the flannel is siphoned from the interior of the filter spool. The coagulant not only destroys bacteria, but drawn by the filtering action into the interior of the fabric of the flannel, forms a sand-like substance that increases the efficiency of the filtering.

The filter takes only eight minutes to unpack and put at work filtering at the rate of 50 gal. per hour. Owing to its simplicity of construction the work involved in cleaning and sterilizing is small and it can be operated

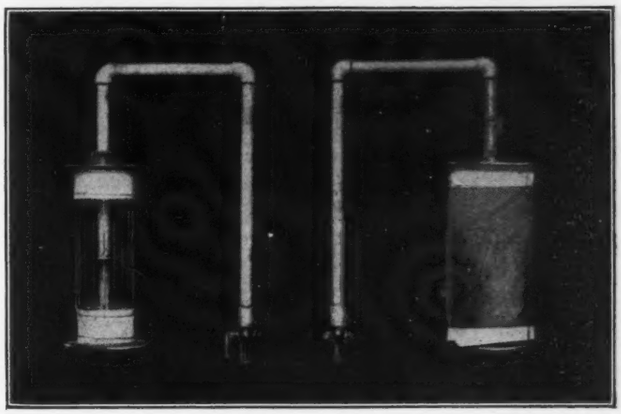


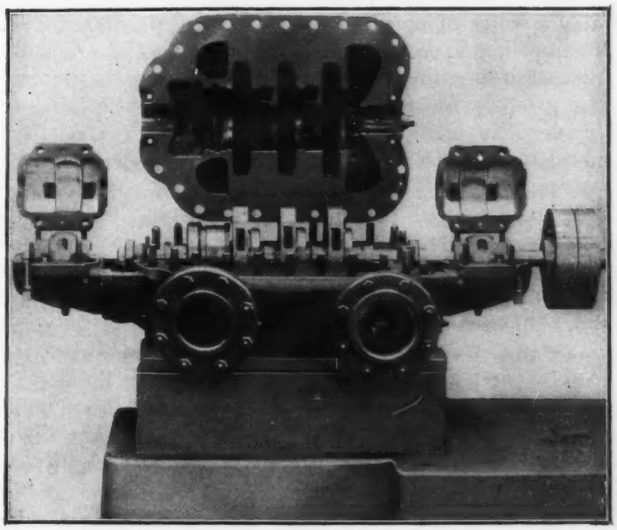
FIG. 2. SIPHON FRAME WITH AND WITHOUT FILTER CLOTH ATTACHED

by anyone of ordinary intelligence. It is packed in 11x16x28-in. crate for transportation or shipment, which forms the stand to support it, as shown in Fig. 1; weight of filter and crate complete is 52 lb.

Improved Centrifugal Pump

The development of the steam turbine and that of the high-efficiency multi-stage centrifugal pump have gone hand in hand, but up to the present it has not been entirely practicable to reconcile the speeds of the two machines so that each would work at its best efficiency.

It has been necessary, heretofore, to reduce the speed of the turbine and sacrifice much of its efficiency or else speed up the pump with similar results. To overcome



HIGH-SPEED CENTRIFUGAL PUMP

this difficulty, the Cameron Steam Pump Works has designed and built a multistage centrifugal pump, known as the "BT" type.

The accompanying illustration clearly shows the construction of one of these three-stage pumps. The high-speed feature is a virtue of impeller design. With the ordinary impeller the diameter cannot be reduced sufficiently to get high speed without sacrificing vane length, and consequently efficiency for a certain vane length is necessary in order that the impeller may perform its function without excessive loss. Small external diameter and adequate vane length are obtained in this pump by bringing the vanes well down into the impeller hub, at the same time so turning them that the incoming water is guided smoothly and with little loss into the outer portion of the vanes, where the velocity is generated that is finally converted into useful pressure by means of the external diffusion vane. Additional advantages in the small impeller are light weight and low fiber stresses in the material.

The casing, as shown in the illustration, is divided along the horizontal center line. Both the suction and discharge connections are in the lower half of the casing. The upper half is readily removable, giving full access to the revolving element. There are suitable openings for draining the pump and for displacing the air when starting. Inlet and outlet nozzles can be arranged either on the same or on opposite sides—an important advantage where pumps are installed in limited space.

The shaft is made of high-grade forged steel accurately machined and ground, and wherever it comes in contact with the fluid being pumped, it is thoroughly protected by bronze sleeves, which prevent the stuffing-box packing from scoring the surface of the shaft.

Each impeller is cast solid in one piece and is of the inclosed type. Surrounding each impeller hub is a pair of rings—one stationary, attached to the casing, and one revolving, attached to the impeller. By the use of double rings instead of a single ring it is possible to restore the initial tightness of the joint between the low- and high-pressure sides of each stage without any fitting whatever, whereas a new single ring would have to be of special diameter and then fitted to the impeller hub of the casing to make a tight joint.

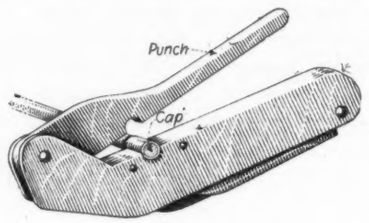
The diffusion ring surrounds the impeller at its periphery, although it is not in contact with it. It contains a series of openings, which receive the water from the impellers at high velocity and, by means of gradually increasing area toward the periphery, reduce the velocity into pressure and enable it to advance to the entrance to the next impeller with much less loss of energy than would be the case if the high velocity of ejection were maintained.

To take care of thrust, which manifests itself in all multistage pumps, this pump is equipped with a simple internal hydraulic balancing device, consisting of a revolving disk attached to the shaft at the inboard, or high-pressure, end. Opposite this disk is a stationary drum of the same diameter. Water at high pressure connects with the space between the disk and the drum, causing the disk to react against the opposing thrust, neutralizing it and holding the rotor in proper relation to the casing. The slight leakage involved in this process is piped back to the suction.

The illustration shows a three-stage type "BT" boiler-feed pump having a capacity of 550 gal. per min. at 3,100 r.p.m. supplied under a pressure of 200 lb. The manufacturers claim that it occupies less space than the ordinary boiler-feed pump of this general type and that it has a much higher efficiency.

A Crimping Knife

A recent U. S. patent (No. 1,184,746) granted to Ole Hanson, of Lead, S. D., covers an ingenious variation of the ordinary jackknife. A hinged arm on the back has its end sharpened to act as a punch. Near the pivot

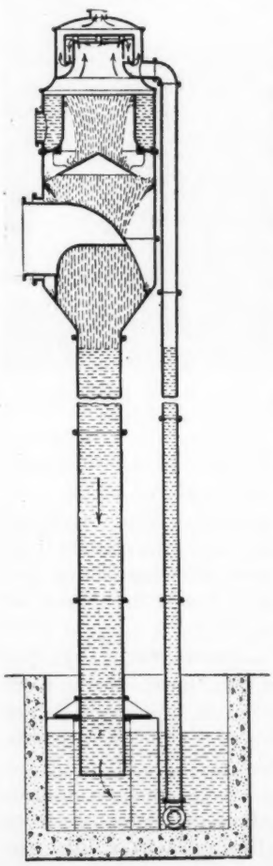


A CRIMPING KNIFE

is a semicircular recess cut partly in the back of the knife and partly in the arm. This recess holds the cap and crimps it on the fuse. This device is recommended to miners as being much safer than the time-honored method of crimping with the teeth.

Beyer Barometric Condenser

Complete steam condensing plants are now being supplied by the Ingersoll-Rand Co. This equipment includes the Beyer barometric condenser, which is of the counter-current type, in which air and cooling water flow in opposite directions. The steam inlet is at the bottom of the condensing vessel, the water inlet above and the air-removal opening at the top. The sheets of cooling water overflowing the pool at the inlet point meet the entering steam. The two are brought into intimate contact by conical baffle-plates, assisting the water to absorb to its full capacity the latent heat of the steam. The noncondensable air liberated in the condensing action rises through the falling water to the removal point at the top, being cooled to practically the temperature of the incoming water. Ample opportunity is given for the removal of the air content of the water before it mixes with the steam. This not only facilitates the mixing process, but permits the removal of air and vapor at a comparatively low temperature—a distinct advantage, as the reduced volume saves in vacuum-pumpage horsepower. The steam inlet is of large diameter to secure low velocity.



THE BEYER BAROMETRIC CONDENSER

The Mining Situation in South Africa

SPECIAL CORRESPONDENCE

The visit of the party of American engineers and the publication of the report of the Government Mining Engineer raised high hopes that the opening of the East Rand basin would be taken in hand, as already far too long a delay had prejudiced the future of the Rand and of South Africa. The government has, at least, become aware of the urgency of the matter, and recognizing that the lower scale of royalties recommended by Mr. Kotze more nearly met his circumstances, they introduced into Parliament a bill on the lines of his report. Unfortunately for the future of the country, an agitation was set on foot in favor of state mining. The authors of this agitation were no doubt well meaning, but they forgot that delay in this matter is fatal and that the government and people of a country can never lose when 12 to 15s. out of every 20s. worth of gold raised is spent in the country, and in addition the state takes about 25% of all profits. Unfortunately the government had to withdraw the bill, and the matter is again hung up.

A new phthisis act was passed, which introduces a drastic reform. After August of this year every miner working on the Rand must submit to a compulsory medical examination, and every one suffering from tuberculosis is to receive £300 to £400 compensation and to be debarred from future underground work. The awards to sufferers from silicosis are increased in certain cases, and it is probable that further drastic regulations wall be enacted to prevent exposure to dust underground.

MECHANICS DEMAND WAGE INCREASE

Some trouble is threatening over the demands of mechanics for increase of wages on account of the higher cost of living. Most of these men receive 20s. per day, but the scale of war bonuses offered by the Chamber of Mines to maimed men and those having dependents does not satisfy the men. There is, needless to say a great shortage of skilled mechanics as, apart from enlistments, over 250 have gone to England for munition work. Having failed to benefit by the bill and other bequests in aid of education in South Africa in starting a university on the Rand, an effort is being made to start one supported by private endowments, but the prospect cannot be said to be bright for obtaining the large funds necessary. In metallurgy very little of a novel character has been brought forward recently. The scope of discovery has apparently been narrowed down to small improvements in details of apparatus and processes. No engineer would have the courage to suggest replacing stamps by stage crushing with rolls, Symons pulverizers, ball mills or other apparatus. As pyrite is much in demand for making sulphuric acid, there does seem an opening for employing a modification of the oil-flotation process to extract iron pyrite from the tailings, and it is just possible that a very small increase in the gold recovery might be made by this means. The local supply is at present being drawn from a deposit 60 ft. wide and 1,500 ft. long on the Areachap farm on the new railway line near the boundary of what used to be German Southwest Africa. This deposit also contains some rich copper ore that is being shipped.

The Kimberley diamond mines of De Beers are washing diamonds from their floors, and mining is starting on a small scale at the Premier mine. Certain producers in German Southwest Africa are allowed to work to give employment to the German population, and the river diggings of the Vaal River also supply stores. North of Pretoria, near the Premier mine, a bench deposit of gravel is being mined with payable results. De Beers and Premier mines have apparently disposed of all their stocks and in view of the American demand are allowing prices to rise. The government, with the idea of establishing a local diamond-cutting industry, imposed a 5% export tax on rough diamonds. This will, however, scarcely be a high enough duty to make the diamond syndicate start a cutting industry in South Africa against its wishes. Since the conquest of the Southwest Territories, the South African government, the Premier and the De Beers, acting together, have had a virtual monopoly of the diamond trade.

POSITION OF THE TIN MINES

Tin mining in Southwest Africa can scarcely be said to be flourishing. No new discoveries are being made. The deposits near Cape Town appear to be exhausted. The Zaiiplaats tin mine, which has been mining exceptionally rich pipe deposits and irregular impregnations in the granite and which has paid nearly £400,000 in dividends, appears to be approaching exhaustion. The Rooiberg Tin Mines, which is mining fissure and fracture plane deposits in quartzites overlying the granite, does not appear to be able to locate payable ore below a very shallow depth. Though its possibilities are by no means exhausted and no systematic development at any great depth has been carried out, it is at present under a cloud. The neighboring Leeuwpoort Tin Mines appear to have the best-defined tin lodes in South Africa and have followed them to a depth of 400 ft. on the incline. Their prospects appear to be good at present. They have between 150,000 and 200,000 tons of tin ore carrying over 2% tin and mill about 3,000 tons per month at a good profit.

The alluvial deposits of Swaziland are being worked by hydraulicking and a portable type of electrically driven bucket elevators which appear to be a success, and fair profits are being made. The alluvial deposits of Swaziland are, however, of very similar size and the richest areas were long ago exhausted.

The Messina mine is almost the only producer of copper ore in South Africa except the old mines in Namaqualand, which appear to be approaching exhaustion. The Messina mine has recently been making a large production, but unless prospecting is rewarded by finding new deposits under the old nature workings, the short pipe-like lenses of the present mine cannot maintain the past and present rate of production. The Ecksteins explored a deposit of zinc ore with some galena in the dolomite near Zeerust, but were disappointed at the extent of the deposit and, after shipping some ore, stopped work. A promising group of silver-lead lodes at Edendale near Pretoria suffered from mismanagement. They are worthy of further development under competent technical direction. It is not generally known that native bismuth and other bismuth ores occur in gold-bearing quartz reefs quite near Johannesburg in the Pretoria series. An English company called the Natal Ammonium Co. has put up very large works near Vyhried in Natal to distill ammonium sulphate and other products

from the extensive beds of oil shale that occur there. Coal mining is active to supply the large demand for local consumption and for bunkering purposes during the war and would be still more active except for shortage of rail trucks. Owing to the continued output of the mining industry, particularly the gold mines, South Africa feels the effect of the war perhaps less than any other part of the colonies of the Empire.

Johannesburg has always been interested in the mineral deposits of Madagascar. Local companies hold large areas of Permian deposits in the northwestern part of the island. Oil seepages are abundant, but the amount of drilling done to date has not succeeded in tapping payable oil deposits, though oil-bearing sandstones are common. The area to be explored is, however, very large and any discovery of oil would be most important. Attention has also been drawn to the occurrence over a wide area of radium-bearing minerals and other rare earths in pegmatite bodies and the detritus from them.

A certain production is being made which would be greater were it not for the war. Graphite is being mined on a fairly large scale but by primitive means. The trouble of economical concentration is being met with here as elsewhere, and there is a possible chance for the introduction of flotation methods.

Superiority of American Pipe

American engineers at work in foreign countries where local conditions precluded the possibility of securing any but English-made pipe, have frequently been humorous or caustic in their comments on results, contributed to the columns of the *Journal*. Readers have been emphatically advised of the superiority of American pipe and fittings, but few reasons have been advanced for that superiority. Those interested in the subject are referred for details to an article entitled "The Manufacture of Water Pipes," by Percy G. Donald, published in *The Ironmonger*, London, June 24, 1916.

The writer is an Englishman empowered by his government to buy pipe for it, after which he had charge of pipe-line construction in Egypt, where extensive lines were built. In his frank admission of the superiority of American pipe over that of English, Canadian and German manufacture, he details reasons for it under the heads of better manufacturing, better threading, better packing methods and lower cost.

English manufacturers are apparently handicapped by lack of a definite set of standards and specifications as regards length, weight per foot and bursting pressure, as well as by the custom of making three different sets of pipe with varying specifications, depending upon whether the pipe is to be used for gas, water or steam. In general, English pipe is lighter than American and uses a considerably finer and shorter thread. The crux of the inferiority of English pipe is apparently found in the difficulty of making tight joints, no matter how heavily coated with red lead. One of the reasons for this appears to be that while the English thread is slightly tapered, incredible as it may seem, the sleeve and other fittings are not tapered. As a result, apertures readily admitting pin points exist where the sleeve joins the pipe. English threads are criticized as too fine by the writer.

Owing to inferior packing methods, 15% of the English pipe had to be rethreaded upon its arrival in the desert, while no American pipe required such treatment. As a result, one pipe-laying gang handling British pipe exclusively could fit only 756 ft. of 6-in. pipe daily, while another gang laid over twice as much American pipe in the same time.

When the water was first pumped through the completed line, a large proportion of the British-made joints leaked, but one could walk for miles along the American-made pipe without finding a single leak. In concluding we quote the English writer's own words: "This is a strong indictment, but when one undertakes work such as this Egyptian pipe-line, possibly the largest of its kind, and hears British sappers and engineers, after experience with Britsh and American pipe, cry with one voice, 'Give us Yankee pipe!' one feels strongly on the point."

Arizona Meeting of A. I. M. E.

Leaving Douglas, Ariz., at 11 p.m. on Tuesday, Sept. 19, the A. I. M. E. special train arrived at Bisbee two hours later. While some of the party were doubtless suffering from the royal hospitality of Douglas, the majority were out next morning for an early start on a visit of inspection to the Bisbee mines.

The second technical session, held that afternoon, was devoted to the subjects of mining and geology. Among other noteworthy papers on the program for presentation were the following: "The Geology of the Warren Mining District," by Y. Bonillas, J. B. Tenny, and Leon Feuchere; "Coöperative Effort in Mining," by Joseph P. Hodgson; and "Gold and Silver Deposits in North and South America," by Waldemar Lindgren. Mr. Lindgren said that the South American resources in precious metals are less than those of the northern continent and that "even progress and enterprise will be unable to raise its production to approach the figures attained by North America."

A further handicapping of the chemical industries of the country, due to a lack of manganese ores, was predicted in a paper by E. C. Harder, of the United States Geological Survey.

David B. Reger, of the West Virginia Geological Survey, in his paper said that the exhaustion of the oil and gas resources of the country is proceeding at a rapid pace, but predicted that the problem of future supply would be partly solved by the securing of deeper producing horizons in high-grade oil regions and later possibly by the mining of deep-sand oil and gas.

The technical session was followed by a most enjoyable banquet and social evening, after which the visitors left for Globe. Here, Thursday morning was spent in a visit of inspection to the mines and reduction works of the Old Dominion company.

At the afternoon's technical session, possible means of developing the flotation process to the greater benefit of the country's mining interests were discussed by the delegates. The discussions were particularly important to mining interests because of the first public presentation of a report of experiments on several miscellaneous wood oils that seem adaptable to use in the flotation process. A statement of some of the values of these oils was presented by R. C. Palmer, of Madison, Wis., Glenn L. Allen, of the Shattuck Arizona Copper Co., and O. C. Ralston, of the United States Bureau of Mines. Another especially striking feature of this discussion was a description by Dr.

Rudolf Gahl, representing Inspiration Consolidated Copper Co., of the exhaustive research and experiments of his company in an effort to develop the flotation process.

Conclusions reached by members representing the leading metal producers of the country were to the effect that the process is now in its infancy and that with the hoped-for discovery of new flotative agents, a brilliant future record is anticipated.

After the evening banquet, the delegates again assembled in technical session to consider the subject of fine grinding. The program included a paper by F. C. Blickensderfer, of the Detroit Copper company, in which he described a comparative test of the Marathon, chilean and Hardinge mills.

On Friday morning the Institute visitors were welcomed at the reduction works of the International Smelting and Refining Co., and at the mills of both the Inspiration and Miami companies.

On resuming the technical sessions in the afternoon, the program included among other noteworthy papers, the following: "Stoping Methods of the Miami Copper Co.," by David B. Scott, and "Mine Fire Methods Employed by the United Verde Copper Co.," by Robert E. Tally.

The paper by W. R. Hamilton, of San Francisco, presented the gasoline-industry data to the meeting and predicted a serious shortage of gasoline on the Pacific Coast, the effect of which is expected to extend throughout the country within the next year. He attributed the future shortage to decreased production of refinable oil (the decrease amounting to 6,000,000 barrels in 1915), steadily increasing consumption, the discontinuance of imports, and the heavy exports due to war's demands.

A paper by Edwin M. Chance depicted the value of chemistry to the coal-mining industry. His conclusions showed the passing of the days when coal is purchased for its looks rather than its heating units ascertained by chemical methods.

At last accounts from *Journal* correspondents, the delegates were anticipating the automobile tour over the Apache Trail to the great Roosevelt Dam, thence to Phœnix, by Saturday night, followed by the Sunday sojourn at the Grand Cañon.

Trail Smelter Reduces Rates

Recognizing the increasing importance of the Valley mining district in Stevens County, Washington, the Consolidated Mining and Smelting Co., of Canada, has authorized a reduced treatment charge on ores that go into its smelter at Trail, B. C., says *United States Commerce Reports*. The Great Northern R.R. has also announced a reduction in the freight rate, both schedules to become effective about Oct. 1.

The reduction rate will be $1.50 per ton on ore that runs between $25 and $50 per ton, and the freight will be $2.45, or a total freight and treatment charge of $3.95 per ton. If ore values exceed $50 per ton, a proportionate additional charge will be made both on freight and treatment.

Molybdenum Ores in Peru have been known for years, according to a recent consular report, but the inaccessibility of the mines and the consequent cost of working them has prevented their exploitation until quite recently, when the prevailing high prices induced some production. The principal mines are at Ricran in the province of Jauja, and Runatullo in Huancayo. The production of concentrates last year was about 4 tons.

NEW PATENTS

United States patent specifications listed below may be obtained from the "Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

ARSENICAL MATERIAL—Process of Treating Arsenical Material. Duncan Anderson, Jr., San Francisco, Calif. (U. S. No. 1,198,095; Sept. 12, 1916.)

CLASSIFIER and Dewaterer. Walker J. Boudwin, Salt Lake City, Utah, assignor of one-half to The General Engineering Co., Salt Lake City, Utah. (U. S. No. 1,197,255; Sept. 5, 1916.)

CONCENTRATING TABLE. Robert H. Richards, Boston, Mass. (U. S. No. 1,197,398; Sept. 5, 1916.)

CONCENTRATION—Process of Treating Ores. Raymond F. Bacon, Pittsburgh, Penn., assignor, by mesne assignments, to Metals Recovery Co. (U. S. No. 1,197,589; Sept. 12, 1916.)

COPPER REFINING. Ulysses A. Garred, New York, N. Y. (U. S. No. 1,198,434; Sept. 19, 1916.)

CRUSHER—Centrifugal Crusher and Separator. Henry Adams, Stamford, Conn., assignor to The Adams Mining Machinery Corporation, New London, Conn. (U. S. No. 1,197,888; Sept. 12, 1916.)

CYANIDING—Method of Extracting Precious Metals from Their Ores. Thomas B. Crowe, Victor, Colo., assignor to The Portland Gold Mining Co., Colorado Springs, Colo. (U. S. No. 1,198,011; Sept. 12, 1916.)

DRILL—Fluid-Operated Tool. Louis W. Greve, Cleveland, Ohio, assignor to The Cleveland Pneumatic Tool Co., Cleveland, Ohio. (U. S. No. 1,198,125; Sept. 12, 1916.)

DRILL SHARPENER. Henry G. Olive, Metcalf, Ariz. (U. S. No. 1,197,846; Sept. 12, 1916.)

DRILLING—Method of Removing Drilling Tools. Walter O. Snelling, Pittsburgh, Penn. (U. S. No. 1,199,819; Sept. 5, 1916.)

ELECTROLYSIS—Method of Reducing Metals. Robert J. McNitt, Perth Amboy, N. J., assignor to The Roessler & Hasslacher Chemical Co., New York, N. Y. (U. S. No. 1,197,137; Sept. 5, 1916.)

ELECTROLYTIC APPARATUS. William E. Greenawalt, Denver, Colo. (U. S. No. 1,198,024; Sept. 12, 1916.)

FIRE BRICK—Composition of Matter for Making Fire Brick. Earl V. Wagner, Scranton, Penn., assignor to The Wagner Fire Brick Co., Helena, Mont. (U. S. Nos. 1,198,171 and 1,198,172; Sept. 12, 1916.)

LEACHING—Process of Making a Leaching Solution for Extraction of Metals from Their Ores. Henry Byron Slater, Los Angeles, Calif. (U. S. No. 1,195,617; Aug. 22, 1916.)

LEAD MATTE—Treating Lead Matte. Utley Wedge. Ardmore, Penn. (U. S. No. 1,198,882; Sept. 19, 1916.)

MAGNETIC SEPARATION—Method of and Apparatus for Separating Magnetic Material. Fried Krupp Akt., Magdeburg-Buckau, Germany. (Brit. No. 100,064.)

MAGNETIC SEPARATORS—Improvements in or Relating to Magnetic Separators. Fried Krupp Akt. Magdeburg-Buckau, Germany. (Brit. No. 100,063.)

NITROGEN—Process of Fixation of Nitrogen. Adrien Badin, Paris, France, assignor to Société Generale des Nitrures, Paris, France. (U. S. No. 1,196,639; Aug. 29, 1916.)

OPEN-HEARTH FURNACES—Utilizing Waste Heat from Open-Hearth Furnaces. Robert M. Snyder, Wilkensburg, Penn. (U. S. No. 1,195,521; Aug. 22, 1916.)

PERCUSSIVE TOOLS—Rotation Mechanism for Percussive Tools. Frederick W. Parsons, Elmira, N. Y., assignor to Ingersoll-Rand Co., Jersey City, N. J. (U. S. No. 1,198,266; Sept. 12, 1916.)

POTASH—Process of Extracting Alkali-Metal Compounds. Henry B. Slater, Riverside, Calif. (U. S. No. 1,197,556; Sept. 5, 1916.)

POTASSIUM SALTS—Process of Recovering Water-Soluble Potassium Salts from Feldspathic Rocks or their Derivatives in the Manufacture of Portland Cement. Frederick W. Huber and Frank Freeland Reath, Riverside, Calif. (U. S. No. 1,194,344; Aug. 8, 1916.)

PULSATING APPARATUS. William A. Smith, Denver, Colo., assignor, by mesne assignments, to The Denver Rock Drill Manufacturing Co., Denver, Colo. (U. S. No. 1,196,040; Aug. 29, 1916.)

QUICKSILVER—Apparatus for Recovering Quicksilver from Its Ore. William H. Landers, New Almaden, Calif., assignor of one-half to Pacific Foundry Co., San Francisco, Calif. (U. S. No. 1,195,236; Aug. 22, 1916.)

ROASTING AND SINTERING ORES, Apparatus for. James Gayley, New York, N. Y., assignor to American Ore Reclamation Co., New York, N. Y. (U. S. No. 1,197,199; Sept. 5, 1916.)

SOLDER—Composition of Matter for Soldering Cast-Iron, Mild Steel, Aluminum, and the Like. William A. Day, Bellingham, Wash. (U. S. No. 1,195,955; Aug. 22, 1916.)

TUNGSTEN POWDER—Art of Producing Tungsten Powder. Frederick G. Keyes and Robert B. Brownlee, Hoboken, N. J., assignors to Cooper Hewitt Electric Co., Hoboken, N. J. (U. S. No. 1,196,699; Aug. 29, 1916.)

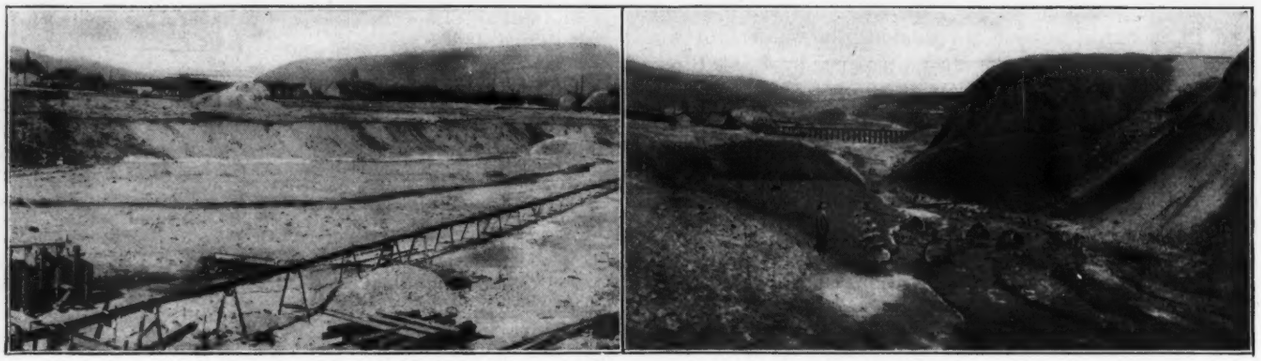
VANNER. Robert H. Richards, Jamaica Plain, Mass. (U. S. No. 1,197,399; Sept. 5, 1916.)

WASHING—Apparatus for Washing Coal and Other Minerals. Paul Habets, Montegnée, near Liège, and Antoine Frange, Liège, Belgium. (U. S. No. 1,197,932; Sept. 12, 1916.)

ZINC—Improvements in Process of Alloying Zinc with Iron or Steel. B. F. Dimm, Erie, Penn. (Brit. No. 2,389 of 1915.)

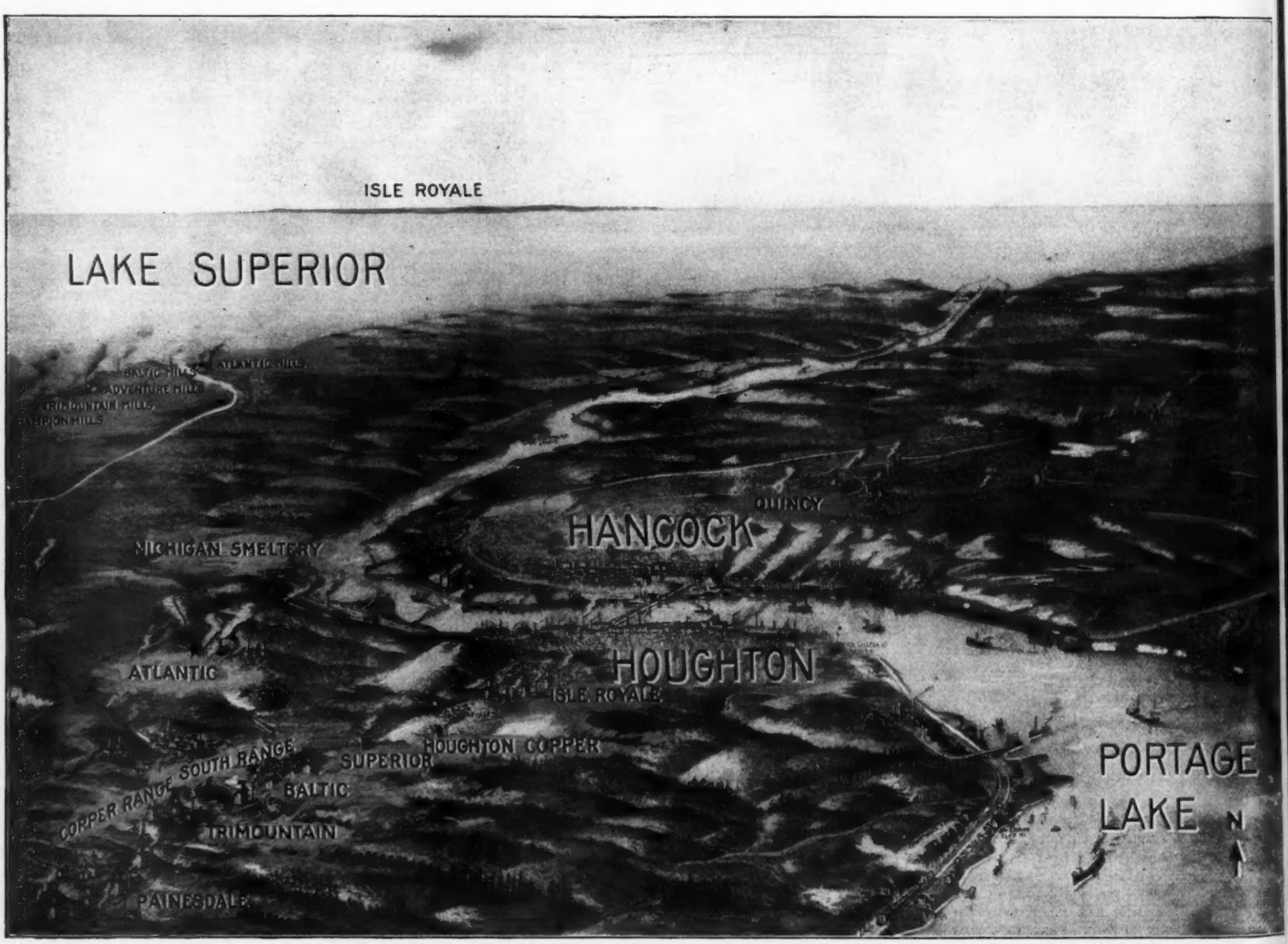
ZINC—Treatment of Zinc Solutions for the Recovery of the Metal Therefrom. Robert Lance, Paris, France. (U. S. No. 1,198,241; Sept. 12, 1916.)

Photographs from the Field

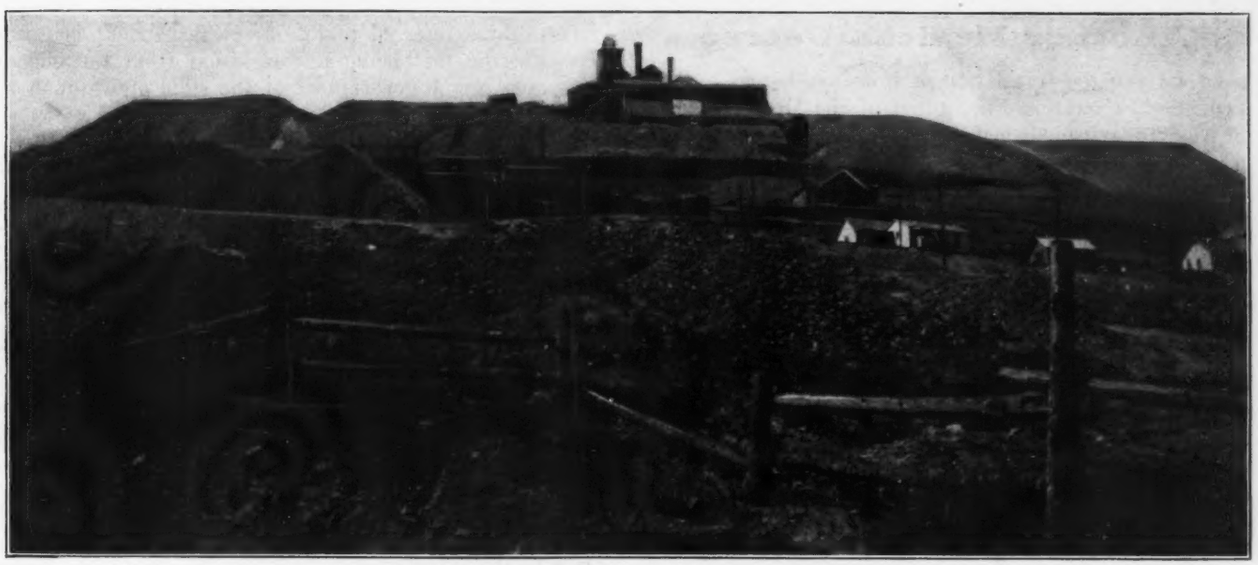


CALIFORNIA GULCH IN LEADVILLE AGAIN TO BE WORKED

Tailings from some of the mills near the portal of Yak tunnel have accumulated in California Gulch, which will now be worked for zinc and lead, instead of for gold, which was the first metal sought in this Colorado field. Ground has been tested by pits at 50-ft. intervals and concentration in two-compartment jig gave a product carrying 20% zinc and 6% lead; it is expected that further concentrating equipment will bring the concentrates up to the usual grade. The enterprise is to be conducted by a small group of Leadville men, headed by Dr. Max Raabe, a practicing dentist. View at left was taken from old Union smeltery dump looking northeasterly toward Leadville. The other view is looking toward California Gulch; Union slag dump on right; Colorado Midland trestle in middle background

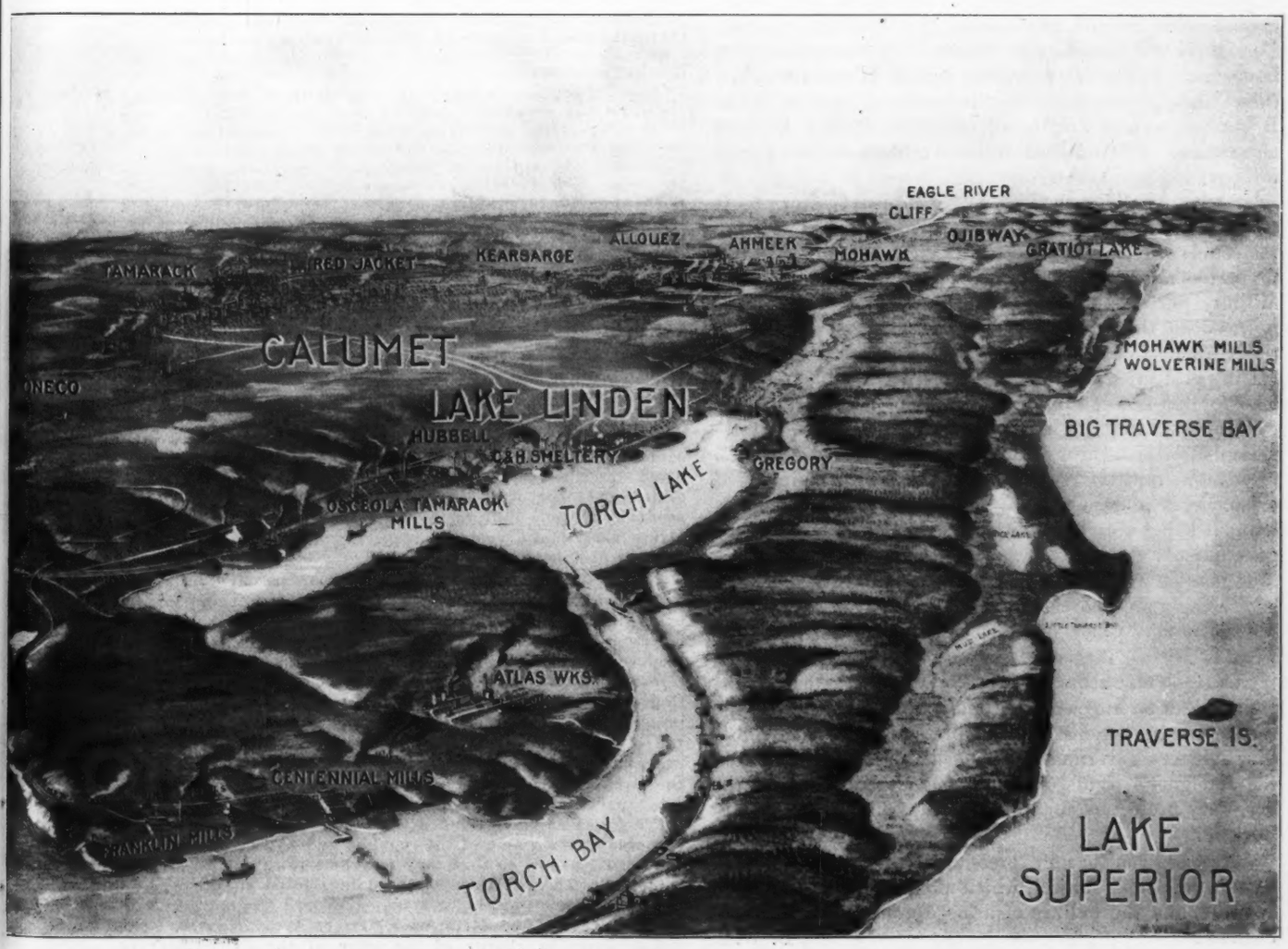


THE LAKE COPPER COUNTRY OF THE UPPER PENINSULA OF MICHIGAN



DUMPS OF THE PORTLAND MINE IN CRIPPLE CREEK DISTRICT, COLORADO

A new cyanide plant is being built to treat these dumps. The new mill is to be erected to the left and lower down the hill, practically beside the Independence mill. The latter is owned by the Portland company and is handling about 500 tons daily by a combined concentration-cyanidation-flotation treatment consisting of classifying, concentrating, leaching of sands and flotation of fines. Lately concentration has been tried on the flotation tails, the small amount of oil and froth contained therein not appearing to interfere with the work of the tables. At the present Portland dump mill—hidden from view in this picture by one of the dumps—about 600 tons are being treated daily by concentration and subsequent cyaniding of the slimes, the sands being wasted.



CONTAINS THE MOST REMARKABLE KNOWN DEPOSITS OF NATIVE COPPER

Another Mexican Decree

I send you the translation of a decree, issued by Don Venustiano Carranza, First Chief of the Mexican Army, on Aug. 15, and published in the official paper of the government of the state of Chihuahua on Sept. 9. You will note that this decree prohibits foreigners from acquiring property in the republic of Mexico unless they specially renounce beforehand their rights as foreigners as far as ownership in Mexico or any contract or agreement with the Mexican government is concerned.

Leaving to editorial discussion the theoretical right or justice of this and similar decrees, the practical questions that interest the foreigner most are:

Can a foreigner count on the protection given by Mexican laws as administered by a party or by a de facto military government actually in power or likely to be in the near future?

Can a foreigner expect for some time to come to get everywhere in Mexico the same consideration from judges and authorities that a native Mexican will receive, or will race jealousy or race spite put him at a disadvantage?

I believe that the orders to come out of the country, given by the United States Government to its representatives and to all American citizens there, answer these questions.

It is not so many years ago that foreigners and foreign capital were invited to come to the Mexican republic. Foreigners who have been in Mexico for any length of time know how anxious native owners have been and are to sell their lands, mines and other interests of various kinds. If foreign owners are to be considered by the Mexican government as naturalized Mexican citizens as far as their interests in Mexico are concerned, it may be well to consider what has happened to native property owners. It seems that many of the larger owners have had to leave the country, as have United States citizens, and that their properties were confiscated permanently or temporarily for military purposes or through military necessities. What redress can they hope for? Is the foreigner, or rather the United States citizen, to have no better chance of getting protection than the Mexican citizen is likely to get, who for the sake of prudence or safety had to leave the country? If he is to be classed as gringo, or spy, or reactionist, or cientifico, or anything else, and new decrees, imposed by military power, are to tax his ownership out of existence, is he to lose his rights for some reason or other, without being able to solicit the friendly assistance of his government?

It may be proper and necessary for our Government to advise the man who has no interests there to stay out of Mexico or any other foreign country, but the man who went to Mexico in good faith to develop internal industry or trade and acquired property there—has he not the right to call on his own government for some help against the oppressive actions of the representatives of a temporary military government which makes laws that burden the foreigner's rights, but does not and cannot give the necessary protection for him to occupy his property or to work it?

May I beg you for an expression of your esteemed views on this particular subject, which affects widely distributed interests and the welfare of a large number of American citizens? B. W.

New York, Sept. 20, 1916.

The decree referred to by our correspondent is given herewith, the text being a translation from the official newspaper of the government of the state of Chihuahua, No. 36, Sept. 9, 1916:

Federal Government. Department of Fomento.

A seal which says: Department of State and of the Expedition of Development, Colonization and Industry, Mexico.

The First Chief of the Constitutionalist Army, in charge of the executive power, considering that our fundamental laws order that foreigners shall enjoy in Mexico the same rights as Mexicans, and that it is natural and legitimate that they shall be under the same obligations and that the liberality of our democratic institutions shall not be understood to reach and shall not reach to that extremity that foreigners who have become owners of property in our country shall stand in a better judicial condition than Mexicans, as deplorably has taken place, and which will happen if over and above being able to make use of their rights, actions and resources, which are granted by the Mexican laws, when their property and their legal relations are concerned, they can also make use of resources and formulate complaints to their respective governments, this same First Magistrate of the Republic, making use of the extraordinary faculties with which he has been invested, has thought it well to decree that the following resolutions of obligatory character be established throughout the whole of the republic:

First. Foreigners who acquire in the Mexican republic free (baldio) or government ground, mining property, water which is subject to federal jurisdiction or permits for the exploration and development of natural wealth, such as forestry products, petroleum, fisheries, etc., shall present themselves beforehand in writing to the Department of Foreign Relations, making a formal, express and decisive declaration that they, in their capacity of owners or concessionaires and in everything that affects or relates to the property which they wish to acquire, will consider themselves Mexicans, renouncing their rights as foreigners and that of applying to their respective governments, demanding protection or presenting complaints.

Foreign companies, which are incapacitated from acquiring rights in any properties referred to in this circular, as long as they are not naturalized, must submit themselves to the Mexican laws and make the foregoing declaration.

Second. It will be an indispensable requisite, before the Department of Fomento, Colonization and Industry can admit any preëmption (denouncement) or request made by a foreigner in the branches referred to in the foregoing resolution, though it be only an exploration permit, that there be presented with the first application a certificate, issued by the Department of Foreign Relations, in which the declaration is made referred to in the foregoing resolution. If this requisite is wanting, the application is to be thrown out and any acts, proceedings or resolutions which may have taken place before the certificate is presented shall be void and of no legal value. In the titles of ownership, as well as in the permits which relate to property before mentioned and which the Department of Fomento has to give to foreigners, and also in the contracts or public documents which relate to the same and have to be authorized by notaries public, the certificate described in the first resolution has to be literally inserted and, moreover, its contents shall be reproduced as a separate clause. Failure to insert the certificate or the said clause shall make void the respective title, agreement, contract or document.

Third. In all proceedings already started by foreigners, and which are under procedure in the Department of Fomento or in its administrative agencies, relating to any property referred to in these resolutions, the proceedings shall be stopped right away and shall not be continued until the interested parties have presented the certificate before mentioned. If within four months, counted from the date of the present resolutions, the certificate has not been presented by the interested party, his request shall be considered withdrawn and the respective proceedings shall be ordered filed in the archives, without recourse on the part of the interested party against this resolution.

The present resolutions will have an obligatory character throughout the whole of the republic and will be published in the official paper, so that they may be known and be strictly complied with, and they shall go into force on the day on which they are issued.

Constitution and Reforms. Mexico, Aug. 15, 1916. The Subsecretary in charge of the office of the Department of Fomento, Colonization and Industry. Pastor Rouaix.

Editorials

The Great Sale of Copper

The great sale of copper to the allied governments that has been talked about for several weeks back was consummated on Sept. 23, or rather, was reported then. The quantity contracted was 200,000 long tons—448,000,000 lb.—a quantity beyond all precedent for a single transaction. This is about 20% of the world's production in a year just previous to the war. It is about one-sixth of what the American capacity for the production of refined copper is expected to be in the early part of 1917. The contract is for delivery running through the first half of 1917. It may be said, therefore, that about one-third of the *expected* output of American refiners for the first half of 1917 has been preëmpted by this one purchase.

It was natural that this spectacular transaction should be the main theme of gossip, surmise and forecast in the daily papers and in Wall Street. American consumers of copper were represented as being confronted by a famine of their raw material. Judging from that sort of talk, it was to be inferred that a new buyer had suddenly grabbed one-third of the prospective supply out of a market that is already being seriously taxed by the needs of current consumption. This is not so—not at all so.

The allied governments made large purchases of copper in the early part of 1916, contracting for deliveries up to the end of the year. It is the filling of those deliveries that creates to a large extent the strength of the copper market now. The war continuing—and there is no reason to forecast its early termination—it was to be supposed that the Allies would require as much copper as they are taking now. So far as the statistical position of the industry is concerned, there is no difference whether they buy it all in one transaction or buy about 33,000 tons per month later. Either way there is just as much copper left for other consumers; probably there will be as large a free surplus as there has been during the latter part of 1916, especially taking into consideration the increasing refinery capacity.

Moreover, the American consumers do not approach 1917 as a preëmpted market. They have, themselves, during the last fortnight been buying very heavily for the first half of the coming year, no doubt in anticipation of the great sale that has just been consummated, for if it had not been consummated on Sept. 23, it would have had to be done later. Producers supplied them with copper at about the same price as was realized in the big sale. It was natural, therefore, that the copper market should have become rather dull after the culmination of what all had been looking for. We shall see prolonged dull periods between now and the delivery of the last of the copper that has lately been sold.

It is to be remarked, furthermore, that all the copper just bought by the Allies is not necessarily going into war material. Rather does it represent the total requirements of Great Britain and part of that of her allies. For Great Britain has now so organized her industrial affairs that the Munitions Ministry supplies everybody, including the manufacturer who is making cartridges for the front and the manufacturer who is making electrical machinery for some industrial purpose. The running of things in Great Britain is no longer at sixes and sevens. On the other hand, a good deal of the copper that has lately been sold to Connecticut brass makers is going into munitions.

What the big sale of copper has really done is to insure to certain producers, especially the Anaconda and those for which it sells, similarly as to Phelps, Dodge & Co. and to the producers selling through the American Smelting and Refining Co., the disposition of a large part of their production in 1917 at a very high price. In this respect Anaconda probably fares best as a single producer. The smaller producers, who do not participate directly in the big sale, will nevertheless do so indirectly, for they will have command of the general market in which the withdrawal of the large quantity of copper already contracted will be a backlog. The copper producers are now guaranteed an extraordinary price for their copper and phenomenal profits in 1916. They are guaranteed the same for a considerable part of 1917. They are entitled to a feeling of satisfaction.

The Attempted Tyranny of Labor Unions

The consequences of the recent surrender of Congress to the railway unions became quickly apparent. In New York there had previously been a strike of traction employees, which had been settled by mutual agreement. After the passage by Congress of the eight-hour law, so called, the leaders of certain unions decided that they would call a new strike in order to demonstrate their authority. The strike was called, but out of something like 13,000 employees only about 3,000 went out. This interfered more or less with the operation of the surface lines, but as to the subway and the elevated railways—the principal arteries of north and south traffic—the traveler would have been unaware that anything had happened, save for the presence of a brace of policemen on each train and occasionally a new trainman not yet provided with a uniform. In the course of a few days the companies were able to put more and more surface cars in operation. The strike had then proved a fiasco.

Appreciating that, the labor leaders resorted to their usual tactics, the first step being to excite disorders, but those were promptly and ruthlessly suppressed by the police. New York fortunately has a mayor with backbone. He informed the labor leaders that his duty was to maintain order in the city, and that if the police were unable to cope with the situation, he would have the state's military on the ground. The next move of the labor leaders was to call a sympathetic strike of all trades unions in New York, on the ground that it is beneath the dignity of union labor to ride to its work on street

cars operated by nonunion men. (Incidentally, it may be remarked that most of the men are union men, and their local union has been recognized by the company, the present trouble being wholly over unwillingness to permit the interference of outside unions.) The last purpose of the labor leaders was simply to throw terror among the populace, by threatening to deprive it of means of livelihood, subsistence, etc. The millions of people in the great city were to be deprived of their right to work, to have light, heat and food, and to enjoy the guaranteed privileges of citizenship simply because the traction companies stood by their 10,000 employees who are satisfied with their employment and refused to break their contract and abandon their own union in order to join the organization ordering the strike. In some ways this situation was similar to what prevailed nationally just previous to Sept. 4, especially in the threats of arrogant labor leaders to subject the mass of the people to great hardship if a handful of citizens could not have their own way. This is the new tyranny of the labor leaders, which was sanctioned by a cowardly Congress. Democratic government was then surrendered by the representatives of the people; fortunately not by the people themselves.

At the present writing it looks as if the general sympathetic strike in New York would also prove a fizzle, and if so, that will be the end of the local traction strike. Reflection upon the recent events in New York produces the poignant regret that Washington did not have the American spunk to fight the thing out with the conductors and engine drivers then and there. If the railway labor leaders had been left to carry out their threats, and if they had done so, probably only a portion of the men would have gone out and probably the principal train service would have been continued just as has been the experience in New York. In New York, fortunately, there is a local government with backbone and nerve, and the fight is being fought. New York may be the new Lexington that is going to inspire the American people to free themselves from its new tyrants

The Copper Stocks

A bull market was well under way, with the leadership of United States Steel, without there being any pronounced stirring of the copper stocks from their prolonged apathy; that is, there were movements here and there, but the bell-wether—Anaconda—scarcely budged. The few stocks that had previously moved upward—like Utah and Inspiration—had good reasons for doing so in the increase of their intrinsic values, or rather the public recognition of it. Thus people, even the well-informed, were slow in appreciating that Dr. Ricketts by conferring upon Inspiration the acme of efficiency in mining, milling and metallurgical methods, endowed it with many millions of previously unsuspected value; but as that was gradually realized, Inspiration advanced in the market. There has similarly been a growing appreciation of Utah's enormous earning capacity and long life and the latent possibility of greatly increased earnings by the introduction of better milling methods. For among the big producers, while Anaconda's and Inspiration's extractions of copper are the most nearly perfect, Utah's is the most imperfect. It is naturally only a matter of a short time before Utah—and also Chino and Ray, which are in about the same position—will wake up to this and get a great deal more copper out of their ore without increasing their cost, just as Anaconda did. Indeed, the awaking is already taking place.

But while these stocks and a few others had appreciated in the market for the reasons mentioned, Anaconda lagged at a lower price than prevailed for it in the early part of 1916 and indeed at a lower price than before the war, although since then the company had remarkably improved its methods of mining, milling and smelting with great increase in its value, had gone more extensively into the general smelting business, which had become very successful, had realized dividends on its large investment in Inspiration, had acquired a promising new porphyry mine of large proportions in Chile, and had gone effectively into the zinc business, utilizing its own important zinc resources, out of which a large profit is already insured. Besides all these, Anaconda had profited largely from the rise in silver as well as in copper and had accumulated a surplus of many millions in its treasury.

Yet the market disregarded all these things, and the stock was sluggish until about 10 days ago. Then with a bull market already in swing, the impending big sale of copper appealed to public imagination and things started in the copper stocks. On Sept. 25 Anaconda sold at 102 and Utah at 99¾, but the full advance was short-lived. A sharp reaction occurred the same day. It was apparently considered that the rises had been too fast, and indeed 10 or 12 points in a week or so was "going some." Nevertheless, it may be regarded that the standard coppers were not even then selling at unduly high levels or out of tune with their real values.

How is the value of the standard coppers to be figured at present? We have forgotten about our old yardsticks of a 15c. average price for copper and liquidating value during known life of mine. Yet we can get our thoughts back to them if we clear our minds. In the first place dismiss all ideas about the 30% earnings on 25c. copper, etc., as promulgated by the Wall Street papers, investors' guides, brokers' dope sheets, etc., and estimate value in the old way. Go back, if you please, to the normal rate of production before the war. Then add the real surplus per share that has been accumulated. Another method would be to figure on the basis of the dividend, whereof the maintenance through thick and thin may reasonably be expected, considering that the accumulated surplus will be a balance wheel to maintain the dividend. Most difficult of computation are those companies that are paying out a very large part of their present great earnings as immediate dividends.

The policy of the copper companies has varied a good deal in this respect. Miami, for example, has increased its dividends proportionately more than any other. Before the war it paid 50c. quarterly. Lately it has been paying $1.50, and there is gossip of a further increase at the next directors' meeting. Although this company is earning more than it is paying out, the policy of the management is evidently to distribute liberally and immediately to the stockholders.

The Hayden-Jackling companies, on the other hand, advanced their dividends to rates that they expect to be able to maintain as a regular thing and then adopted the policy of declaring extras. Probably they could not resist the demands of their stockholders, but in granting them we imagine, nevertheless, that the Utah directors

anticipate their ability to maintain their regular $6 per annum as far ahead as anybody can think and intend to keep such a reserve fund as will insure their doing it.

As for Anaconda, it had already demonstrated, before the war, its ability to pay $6 per annum year in and year out. It did not earn it every year, but in some years it earned a good deal more than was necessary and preserved a surplus to supply the deficiencies of the lean years. Anaconda is apparently going to adhere to its old policy, but if it could pay $6 before the war, certainly the change in its conditions should enable it to do something better now and keep it up indefinitely. In fact, the Anaconda directors raised to an $8 rate last quarter and have just declared at the same rate for this quarter, wherefore we may assume that it is what they have in mind to maintain as a regular thing. The question is then, "What is the value of Anaconda as an 8% industrial stock?"

Nobody can but admire the conservatism with which the affairs of most of the standard copper companies are being administered during this period of intoxication. As for their relations to the public, there is no group of companies that tell so fully, so frankly and so frequently about what they are doing. The interest in them is so great, indeed, that the limelight is thrown on them all the time. About the only thing that gives anybody concern is what may be the price of copper after the war. Let us assume the worst. Let us assume that the production may be so stimulated that competition in a waning market may put the price down to 12c. or even 10c. per lb. pending readjustment of conditions. The accumulation of cash now taking place ought to take care of that. In other words, after two years of 25c. copper we might have four years of 10c. copper and still have an average of 15c. for the six years. However, nobody is thinking of 10c. copper, anyhow.

BY THE WAY

A writer in a contemporary considers mining "the most human of all industries"; that is, in its earlier stages. He laments that the extensions of mining in recent times are making it a matter of engineering and machinery and depriving it of the human interest. His ideal is the placer miner with his rocker and "long tom" in some California or Georgia gulch, and his special abomination such exploitations as the Alaska Treadwell, the Utah Copper or a big Mesabi iron mine.

⁂

We do not often publish anonymous letters, but the following, which came from London, must have amused the British censor, who opened and read it, as it did us and as it will our contributor to whom it is addressed.

To the MAN FROM MEXICO

1st September, 1916

After reading your article on "The Mexican Situation" most carefully I have come to the conclusion that you know nothing about the subject you treat, further that you are a DAMNED FOOL! and like all other Americans I have had the misfortune to meet, you are a confoundedly unscrupulous LIAR! A swanky-Pott!! and a WRETCHED LOWN DOWN CONCEITED BLACKGUARD!!!!! A-MEXICAN—

who knows.

Viva Mexico!! y MUERAN LOS GRINGOS!!!!

What is a "swanky-Pott?"

St. John Del Rey

The St. John Del Rey Mining Co. for the year ended Feb. 29, 1916, reports a production of 215,000 tons, yielding about $10.50 per ton in gold from its Morro Velho mine, Morro Velho, Brazil. The total cost of mining, milling and development, State and Federal Government duties and general expenses in London amount to about $7.21 per ton of ore. There was also transferred to capital account for improvements an amount equal to about $1.15 per ton. A summary of the work done during the year shows that 3,513 ft. of drifts was run, 294 ft. of shaft was sunk and that 5,600 cu.ft. of excavations was made. In addition to this, 5,040 ft. of airways was opened. Of all the ore hoisted, 2.12% was rejected as waste as compared with 1.81% in 1915 and 0.08% in 1914. Mill recovery averaged 93.52%. The following list taken from the Store Department's Report shows the rise in price of some of the most important stores purchased in England during the past year:

INCREASE IN COST OF SUPPLIES

	% Increase		% Increase
Acid, muriatic	29	Magnolia metal	43
Borax	6¼	Percussion caps	11
Bolts and nuts	40	Phosphor-bronze ingots	10
Babbitt metal	7	Steel borer	12
Crucibles	10	Steel plates	31
Cement from England	133	Sacking	13
Carbonate of soda	8	Soft soap	44
Dynamite	8¾	Safety fuse	3
Filter cloth	36	Shovels, miners'	23
Hose for rock drill	8	Wire, G. P., for mine	8½
Iron bars	21	Wire gauze	20

After the prohibition of zinc as an export from England it became necessary for the company to obtain any zinc it could in Brazil and 12.5 tons of sheet zinc was purchased at a price 141% over that paid for the last consignment from England. Steel plates purchased in Rio were 164% above the price for which they could have been imported from England. Iron bars showed an increase of 119% and explosives, taking into consideration the decreased nitroglycerin content, advanced 35%.

Owing to a loss in transmission from generating stations to the axles of the motors at the mine, which may be taken at 10% more or less, the effective horsepower delivered at the mine amounts to about 2,975. The approximate daily hydraulic power has been 520 hp., and that of steam and gas engines, which had to be made use of during the dry season, amounted to 75.5 hp. The entire running cost in each case of the horsepower delivered per 24 hr. is given as follows: Electrical power, 4.68c.; hydraulic power, 5.78c.; steam and gas power, 51.80c.

It is stated that the hydraulic power cost is increased owing to the fact that the water is brought to the mine from several small sources, as well as from one large one and by water courses of great length, and a considerable portion of the water brought in is used as milling water and for other purposes, which represents power but is not estimated as such.

⁂

Gold-Mining Machinery May Be Imported in Russia Free of duty, according to an imperial decree dated May 13-26, 1913, reported by the "Board of Trade Journal" of London. To assist the gold-mining industries of the Urals and Siberia, gold-mining apparatus is to be admitted free of duty for a period of 10 years. The decree covers gold dredges, complete, as well as appurtenances such as electric motors, boilers, drilling apparatus and casing; also equipment for crushing gold ores and extracting the gold by chemical processes, such as cyanidation, etc. This decree should be of material assistance to the Lena Goldfields, as this company has in contemplation an important installation of dredging equipment on its extensive property near Bodaibo, Siberia.

PERSONALS

H. Foster Bain is going to China in October.

M. L. Requa has returned from Alaska to San Francisco.

John F. Spedding, recently at Ely, Minn., is now at Nagpur in British India.

E. A. Austin is now at Jarbidge, Nev. He was lately at Iditarod, Alaska.

C. W. Purington is in New York. His headquarters are at the Harvard Club.

Edwin E. Chase and son, of Denver, have gone to southern Nevada on mining business.

Paul Wels has gone from Brooklyn, N. Y., to the Cerro de Pasco Mining Co., La Fundicion, Peru.

Harry B. Barling has returned to New York after a professional trip to several of the Western States.

J. L. Head, recently at Flat River, Mo., is now with the Calumet & Arizona Mining Co. at Warren, Ariz.

Edward L. Dufourcq has removed his offices as consulting mining engineer to No. 18 Broadway, New York.

F. W. Schumacher, president of the Schumacher Mining Co., of Porcupine, Ont., is making an inspection of the property.

Wilson W. Hughes, formerly at Guanajuato, Mexico, is now with the Monitor Belmont Mining Co. at Belmont, Nev., as superintendent.

Charles F. Williamson is now at Reno, Nev. He was formerly mining engineer for the Cananea Consolidated Copper Co. in Mexico.

Kirby Thomas, of New York, has been for some months investigating the iron ore resources of southwestern Virginia and east Tennessee.

L. L. Morrill will have charge of the New York office of Mason, Fenwick & Lawrence in the St. Paul Building. He was lately in their Washington office.

L. R. Wallace, formerly superintendent for the International Smelting Co. at Miami, Ariz., has gone to Chile to take charge of a smelting plant there.

F. G. Clapp and **C. T. Griswold** have recently been engaged in geological examinations in Texas on behalf of clients of the Associated Geological Engineers.

Edward J. Cornish has been elected president of the National Lead Co. in place of W. W. Lawrence, deceased. He has been vice-president for several years.

A. L. Conner has been promoted to general manager of the Gulf States Steel Co., succeeding C. A. Moffett, who has been advanced to vice-president of the company.

L. O. Howard, formerly superintendent of the Old Dominion smeltery and mill at Globe, Ariz., is now in charge of the International Smelting Co.'s works at Miami.

O. J. Fisk and **R. J. Goodwin** are conducting a series of chloridizing, roasting and leaching tests on the copper-platinum ore of the Boss mine, Goodsprings, Nev.

P. J. Freeman, professor in the department of applied mechanics of the University of Kansas, has resigned to become engineer of tests for the Pittsburgh Testing Laboratory.

C. W. Hays, formerly with Boyts, Porter & Co., Connellsville, Penn., is now associated with the Ross Mechanical Supply Co., Pittsburgh, in charge of the pump department.

George S. Patterson, formerly with the New Jersey Zinc Co., at Franklin Furnace, N. J., has assumed the superintendency of the Northern Ore Co.'s property at Edwards, St. Lawrence County, N. Y.

H. H. Colley has succeeded L. O. Howard as superintendent of the Old Dominion mill and smeltery at Globe, Ariz. Mr. Colley was formerly assistant smelter superintendent at the Copper Queen works at Douglas.

Archibald G. Smith, general superintendent of the open-hearth steel plant of the Youngstown Iron and Steel Co., Youngstown, Ohio, has resigned, and it is stated will go with the Trumbull Steel Co., Warren, Ohio.

W. E. Donaldson, for several years with the Carnegie Steel Co., has been appointed special agent for the United States Steel Corporation in charge of the slag department. This is a new department, having charge of the commercial use and distribution of slag.

Herbert C. Hoover, Chairman of the American Commission for Belgian Relief, narrowly escaped being struck by a bomb when on the Dutch steamship "Prins Hendrik" which was seized by German naval forces while bound from Flushing for London. It is said that the steamship was attacked by an allied aëroplane, which dropped a bomb wounding a passenger who was standing beside Mr. Hoover.

Robert E. Cranston has been appointed consulting engineer to the Mining Associates, Ltd., operating the Rawley mine, near Salida, Colo. He is developing and equipping the property for production, and expects to make periodic trips to the property during the course of this work.

C. J. Barr, superintendent of the steel plant and furnace divisions of the Tennessee Coal, Iron and Railroad Co., at Ensley, Ala., has resigned to accept the management of the Algoma steel mills at Algoma, Ont. He is succeeded by **W. G. Mathias,** assistant general superintendent. **Karl Landgrabe,** superintendent of blast furnaces, succeeds Mr. Mathias and is in turn succeeded by **W. H. Oldham.**

H. R. Hanley, until recently general manager of the Bully Hill Copper Co., has been appointed superintendent of the new electrolytic plant that the U. S. Smelting Co. is going to erect near Kennett, Calif. Mr. Hanley was one of the most important factors in the development of the electrolytic process in the Bully Hill experimental plant, and much of the knowledge of details that makes this a workable process is due to him.

Hector F. Escardo, mining engineer of the Cerro de Pasco Mining Co., and **William Bull,** both Peruvians, were visitors in Butte recently. They are making a study of mining methods and water power development as it has been carried on by the Anaconda Copper Mining Co. and the Montana Power Co. in the Butte mines and Montana districts. They spent a couple of days making a study of the Washoe works at Anaconda where they were the guests of E. P. Mathewson, general manager of the plant. They also paid a visit to Great Falls to inspect the new copper and zinc refineries. While there they visited the plants of the Montana Power Co. at Big Falls and Rainbow.

OBITUARY

Anton Huth died recently at Spanaway, Wash., aged 63 years. He was president of the South Keystone Mining Co., Amador City, Calif. He was also interested in several other mines on the Mother Lode and in Washington.

Sir Sigmund Neumann for years a prominent figure in Transvaal gold mining, died at his residence at Bournemouth, England, Sept. 6, aged 59 years. Sir Sigmund was the sole partner in S. Neumann & Co., merchants, and partner in Neumann, Lubeck & Co., and was connected with a number of public companies. He was chairman of the Salisbury House Estate and a director of the African Banking Corporation, the East Rand Proprietary Mines, the London Joint Stock Bank, the Premier Diamond Mining Co. and the Rand Mines. In 1912 he was given the title of baronet, which will be inherited by his son Cecil.

SOCIETIES

American Chemical Society—The annual meeting begun in New York, Sept. 25 with a large attendance.

American Mining Congress—The nineteenth annual meeting will open at the Hotel La Salle, Chicago, Nov. 12. One of the chief subjects will be the Revision of the Mining Laws.

Mining and Metallurgical Society of America—At a meeting of the New York Section, held at the Engineers' Club, on Sept. 21, the following officers were elected: W. R. Ingalls, chairman; W. Y. Westervelt, vice-chairman; D. M. Liddell, secretary-treasurer.

Chicago Association of Commerce—Three cash prizes, $50, $30 and $20, are offered by the Engineers' Subdivision of the Chicago Association of Commerce for the three best papers, not to exceed 3,000 words, on any one of the following subjects: (1) "Engineering and Civic Progress." (2) "The Engineer of the Future." (3) "The Business Relation of the Engineer to the Commercial World." The contest is open to undergraduates and graduates of any recognized school of engineering in the United States during the years 1915 and 1916. The judges of the relative merits of the papers will be F. H. Newell, professor of civil engineering, University of Illinois; John W. Alvord, consulting engineer, Chicago, and John F. Hayford, director, College of Engineering, Northwestern University. All papers should be mailed to Engineers' Subdivision Contest, the Chicago Association of Commerce, 10 South La Salle St., Chicago, and must be received not later than Nov. 1 next.

Editorial Correspondence

JACKSON, CALIF.—Sept. 25
(By Telegraph)

Strikers Now Quiet. Three hundred paraded on Sunday. Three cases of assault by strikers; one man badly beaten; one house and one automobile stoned; three arrests made. All mines in good condition to stand long shutdown. Plenty of men ready to work if protection were assured.

SAN FRANCISCO—Sept. 19

Closing of Gold Mines in Amador County occurred Sept. 19 as a result of too much Union Federation of Miners. For several months there has been a quiet agitation carried on along the Mother Lode, supposedly by direction of the Union Federation. The operators of 11 gold mines, including all the producing mines in Amador County, knowing that this agitation was going on and anticipating that the demand for increased wages would be made, posted an announcement on Sept. 2 that if such demand were made, the mines would be closed. This announcement was published in the "Journal" of Sept. 9. The local branch of the federation at Jackson denied positively that there was any thought of a strike or demand for increased wages. The union seemed to be indignant at being charged with strike intentions after wages had been voluntarily increased by the mine owners some months ago. The operators were not inclined to believe the denial of the intended demand and kept a sharp lookout for developments. On Sept. 15, a notice was addressed to the mine operators and owners of Amador County by the secretary of the local union, inviting the operators and owners to discuss the matter of establishing a uniform wage scale for Amador County. The substantial contents of the notice follows: "The union will meet you individually or collectively, preferring the latter. If any operator or owner does not communicate with us respecting this matter before Monday, Sept. 18, 1916, it will be taken for granted that such operator or owner refuses to meet the union." Evidently the federation took the silence of the mine owners to mean that they would not recognize the union. In that surmise the union is no doubt entirely correct. It may also be assumed that if the announcement of Sept. 2 had not been posted, there would have been a concerted demand by members of the union for an increase of wages or for establishment of a uniform wage scale. It is not at all certain that the men, who are not members of the union, would have joined in the demand for increased wages and it is even probable that all of the members of the union are not in harmony with the leaders. In the town of Plymouth, a number of miners working at the Plymouth Consolidated have recently acquired new homes, a number of which have not yet been fully paid for. These men like other men of family in other camps in the county are desirous of maintaining their homes and continuing their employment. So there is a disposition on the part of a probable majority of the mine workers in Amador County to let well enough alone, particularly since they are aware that the increased cost of gold mining, without increase in the value of product, is sufficient cause for owners and operators to refuse any further demand for increased wages. This walkout, if continued, will not permanently injure the large owners, but it will cripple some of the smaller operators and will drive investors away from Amador County and for a long time have a depressing effect upon the gold-mining industry of the state, as well as upon Mother Lode activities.

Consulting and Safety Engineer is the title of a position created by the California Metal Producers Association to be effective on Nov. 1, 1916. Edwin Higgins, chief mine inspector for the Industrial Accident Commission, will occupy the position, resigning his present office on Oct. 31. The duties, so far as the association as a whole is concerned, will consist in consultation and advice as to the best methods of mine safety in conformity with the law of the state, suggestions and assistance in the selection of safety devices, and the keeping of records for the benefit of members, relating to the safety situation. But in addition to these duties Mr. Higgins has entered into a contract agreement with a number of the largest mines in California to make regular visits of inspection on the surface and underground, consult with the superintendents and managers and advise in particular regrading safety methods, devices and practice; in fact, to assist in placing these mines in the safest condition possible. The mines that have entered into this special contract, to date, are the following named on the Mother Lode in Amador County: Argonaut, Kennedy, South Eureka, Bunker Hill, Fremont, Plymouth Consolidated, and the Empire in Nevada County. Other mines have already tentatively agreed to the undertaking and before the date of this publication will no doubt have entered into the contract. The successful carrying out of the plan will without doubt add largely to the number; some of the managers already agreeing upon the practicability and the terms of the plan, await the confirmation of the directorate of their companies. The mine owners and operators have no desire to take mine inspection out of the hands of state officials, nor to make a law unto themselves; but wish solely to make their properties so safe to workmen and so thoroughly in accord with the laws governing mine safety that the duties of official inspectors will be less arduous and less costly; to aid the state in the effort to insure the safety of miners and the protection of mine property. It is not improbable that every important producing mine within the membership of the Metal Producers Association will become a party to this special agreement to secure first-hand service of an expert safety engineer. The ultimate result of the success of the plan should be the placing of the mines in California in a position far in advance of the present and provide for a reduced rate of mine insurance. Mr. Higgins has had 12 years' experience in this character of work in connection with the U. S. Bureau of Mines and as practical mine superintendent. He is a graduate of Lehigh University, with the class of 1902. He was for two years assistant editor of the "Journal" and in that experience visited some of the most important mining states and gathered a broad knowledge of mine conditions and studied a large field of "details of practical mining."

BUTTE—Sept. 21

U. S. Bureau of Mines Rescue Car will soon be coming to Butte. The federal government has selected Butte as the headquarters for one of the three new mine-rescue cars and it is understood that the cars will be ready by the end of the year. Each car will carry a crew of six men and will cost $20,000. Butte's car will be stationed near the School of Mines in the western part of the city. R. A. Hill, of the U. S. Bureau of Mines is expected in Butte within 10 days to organize the Butte miners into teams for training in this work.

Montana's Accident Board has just issued its first report for the 12 months ended June 30, 1916. The financial statements as well as the general effect of the workingmen's compensation law upon Montana's industries, as presented in the report, prove the law to be a good one and the administration of it during the first year highly commendable. In compensation, medical and hospital fees the board paid out during the year the sum of $293,399. This was distributed to 6,802 injured employees and to beneficiaries and dependents. Pending cases under all plans at the end of the year aggregated about $95,000, making a total liability for the year of about $1,100 a day. Of the total number of accidents 136 were fatal for which compensation amounting to $169,111 was awarded. The other cases were permanent-total, permanent-partial and temporary disability. The real truth and cause back of these gratifying figures rest in the fact that because of the stimulus of the law all of the employers and employees of the state are now engaged in a most active rivalry to surpass in the "safety first" propaganda, with the result that both fatal and minor accidents are becoming of less frequent occurrence in all industries. While the law is elective, it has been accepted by 96% of the employers and 98% of the employees in the state. During the year there has in no instance been an appeal from the ruling of the board, showing that the law itself and its administration have been satisfactory to both employers and employees.

DENVER—Sept. 19

Sale of Mount Champion Mine, which is above timberline on Mount Champion in the Saguache Range, southwest of Leadville, has been announced in most of the Colorado newspapers. This mine has been making a splendid record despite its handicap as to situation and it is unquestionably in a fine condition to continue its production of high-grade gold ore, but the "Journal's" correspondent is informed, on the best of authority, that the deal for the transfer of the

property has not actually been consummated although all interested parties are now in New York conducting negotiations.

Tungsten Prices in the Boulder Field remain around $18 to $23 per unit for 60% concentrate, and $15 to $20 per unit for 60% ore. This difference is due to the fact that concentration removes objectionable elements in the crude ore. For 25% ore, the price per unit varies from $9.40 to $10, while for 10% ore, the price is $7.80 to $9 per unit. In the northern portion of the field, the National Tungsten Mines Co. has finished the erection of its mill building in Spring Gulch and the machinery will be installed soon.

SALT LAKE CITY—Sept. 22

The Haulage Question in Big Cottonwood is presenting further difficulties; and the mining companies, which—since the failure of the transportation company organized to use tractors and trailers—have been using horse-drawn vehicles, are threatened with legal action on the part of the city. As before stated in these columns, the cause of the controversy is the matter of city water coming from the cañon. In the spring the road was improved and widened by joint contribution from the city and county, and the mining companies, with a view to the elimination of teams. The mining companies are offering to give more money for road work, in the same proportion as before. The companies chiefly concerned are the Cardiff and the Boston Development, the latter operating the Maxfield mine. The Cardiff—recently developed into an important producer—is at present shipping about 120 tons daily, bringing its ores to market by the use of teams, and motor trucks. Hauling in the Cottonwoods is at all times hampered by the steepness of the grades and the shortness of the shipping season.

Ohio Stockholders' Protective Committees, in Salt Lake City, New York and Boston are taking action and have made public announcements asking for the deposition of stock by its holders. A New York committee, consisting of C. E. Graham, Frederick W. Frost, W. J. Brown, A. W. Middleton, E. C. Devereux and C. H. Stanton, asks that the stock, duly endorsed for transfer be deposited at the earliest possible date with the Central Trust Co. of New York, 54 Wall St., New York, and will provide certificates of deposit for all stock issued. Another New York committee, sponsored by the North American Liquidating Co., consists of Charles A. Kittle, George E. Macomber, Frank B. Cook, Edwin S. Hooley and H. E. Rogers; its depository is the New York Trust Co. The Salt Lake committee, made up of George Baglin, W. M. Havenor and J. R. Whitney, has made a similar announcement to Utah stockholders, naming the Columbia Trust Co., of Salt Lake City, as the depository. The committee announces the belief that a feasible plan can be worked out for the reorganization of the company, in such a manner as to save the property to the stockholders, if sufficient stock will join in such a movement. It is estimated that there are between 75,000 and 100,000 shares of Ohio Copper stock owned in Utah.

MIDAS, NEV.—Sept. 20

Gold Circle District, reached from Midas, continues to be active. Last year, the Dorr company built on the Elko Prince property a mill of 50 ton capacity. The mill began operating in the autumn and has been running steadily ever since on ore that was supposed to go about $48 per ton; down to the 700 level there was estimated to be $1,250,000 in sight. Work since then has indicated that the value of the Elko Prince was under-estimated as the vein proved wider and richer as depth was attained. The Elko Prince company last year gave a lease on its June Bell claim to Paul Ehlers who has opened a parallel vein about 400 ft. from the Prince vein. Ehlers has taken out about $20,000 worth of ore from his lease. The Prince company decided to crosscut to the June Bell from its main working tunnel and found the vein which gives every appearance of being the equal of the original vein. Unfortunately for the camp, the Prince gives out no facts or data about the work but it sends out monthly from 8 to 9 bars of bullion that weighs about 1,200 lb. Next to the Prince is the Judge property under lease to Hayes & Raymond. Their last crushing was 28 tons which went $120 per ton. It is now a company under the name of the Old Judge Leasing Co. which has decided to purchase an electric hoist and sink 200 ft. from the level of its adit. About a mile south is the Rex mine and mill. At present the 5-stamp mill is leased to the lessees of the Queen mine who haul their ore there for $3.50 per ton. The Rex mine was operated intermittently for six or seven years and produced about $400,000 to the 200-ft. level. The workings are in bad shape but last year Howell and Liddell had the Rex and the Colorado Grandee No. 3 under lease and they did well. They took about 4,000 tons from the Grandee that went from $6 to $12 per ton; the vein is from 8 to 10 ft. wide but has not been opened below 185 ft. Last winter Martin Brown and Jacob Jacobson took a lease on the old Queen property in the southern part of camp and they have opened a large body of low-grade ore some of which goes from $16 to $20 per ton. William Ray leasing on the Missing Link is sending a crushing to the Prince mill for treatment; it is about 25 tons, estimated to go $60 per ton. He sent a 21-ton shipment to the Murray smeltery this spring that went $113 per ton. Up the cañon about 2 mi., Charles Randall made a good strike this spring, the ore running high in silver; in fact, the silver predominates. He is down about 40 ft. and has just sent 12 tons of high-grade ore to Red House, 28 mi. away, for shipment to the smeltery.

JOPLIN—Sept. 23

Organization of Mine Operators of the Joplin district is scheduled finally for Sept. 25 when a meeting will be held in Webb City, Mo. The new organization is to be strictly an ore-producers association, no one being eligible who is in any way affiliated with the smelting interests. Every member must be a "bona fide" ore producer whose interests in that industry are paramount to any other interest engaged in, it being the desire of the association to prevent the possibility of divided interests, breaking into the activities of the organization, a feature that has always been a disturbing factor in past efforts of organizations in the Joplin field.

Lower Prices for Powder was the unofficial prediction of an official of one of the big powder companies in an informal address before a meeting of mine operators here. This ray of sunshine was brought by N. P. Rood, of the Hercules Powder Co., who said that there had been one reduction of $2 per hundred in the price of powder since May, and that another reduction would probably take place before the first of the year. Any reduction of powder cost will be a welcome feature to the sheet-ground districts where there has been a large decrease in production because of the inability of the mine operators to hold the cost of production down to a point below the price received for their product. While ore prices have returned to somewhere near before-the-war quotations, powder is still selling at greatly advanced prices, seriously handicapping many of the sheet-ground mines.

Surplus of Zinc Ore is estimated at 17,000 tons for this district by Richard Jenkins, secretary of the Southwest Missouri Mine Safety and Sanitation Association, after a careful survey in which he was assisted by special representatives in virtually all the camps. This is a reduction of about 6,000 tons in the past six weeks, but it has come about almost entirely during the last two weeks, when purchases have been much heavier than production. Previous to this, production while much curtailed has been steadily greater than the amount of ore purchased each week. Those mines closed because ore faces were too thin to work at a profit with $65 ore, and the mines down on account of lack of water for wet concentration, have remained closed. In addition, during the last week there has been added curtailment through inability to get electric power for anything besides pumping. The new turbine at the Riverton, Kan., plant of the local electric company is being put in operation and until it gets completely in going condition there will be a shortage of current.

DULUTH, MINN.—Sept. 23

Mesabi Range's Greatest Tonnage is being attained this year, in spite of a strike which closed many of the underground mines for a few weeks. Only one or two mines on the entire range are now closed and they will not be operated during the winter. The Mesabi is sending out more ore than at any time in its history. Every ton is being moved that the railroads and boats can handle. Much more could be mined if the transportation facilities permitted. There is a general belief among the mining men that there will be an increase in iron-ore prices for 1917 and the underground mines will undoubtedly endeaver to get out all of the ore that they can during the winter months for shipment next year. They have felt right along that the 1916 prices were not high enough and some have refused to dispose of their higher grades, preferring to hold them for higher prices. This is not only true on the Mesabi but on some of the Michigan ranges as well. The possibility of higher prices will be a big stimulus to the mining business and the entire Lake Superior district should have one of the busiest winters in years.

TORONTO—Sept. 23

Prospecting Expedition into Greenland is being arranged by a party of experienced prospectors of Northern Ontario, including A. H. Reamsbottom, of South Porcupine and the McDonough brothers, pioneers of the Boston Creek field. An old Yukon prospector who died last year claimed to have discovered rich placer deposits in Greenland six years ago and left samples of the gold and charts showing the route and location, which will be used by the party who propose to reach Greenland by taking their own boat from Labrador.

The Mining News

ALASKA

ALASKA MINES CORPORATION (Nome)—Formed to acquire 1,860 acres of placer ground and dredges of Nome Consolidated, not especially profitable under former management. New capital and additional ground and dredges to be provided by present organization. New officers and directors are: James C Gayley, president; Theron I. Crane and Henry B. Livingston, vice-presidents; W. S. Reed, secretary and treasurer; August Heckscher, Mahlon W. Newton, Louis H. Eisenlohr and E. E. Powell. F. H. Minard, 111 Broadway, New York, is to be consulting engineer.

ARIZONA

Gila County

A. J. BOVARD AND B. F. REYNOLDS, of Rawhide, Nev., report rich gold strike 10 mi. north of Globe; 20-in. streak runs $100 a ton.

GREATER MIAMI COPPER (Miami) — Development being pushed; contemplate erecting 50-ton mill.

INTERNATIONAL SMELTING (Miami)—Producing about 16,000,000 lb. copper monthly; L. O. Howard is now in charge.

SUPERIOR & BOSTON (Copper Hill)—Stoping in oxidized zone from 800-ft. level upward. Sinking McGaw shaft to 1,400 level.

ARIZONA COMMERCIAL (Globe)—Posted initial dividend of 50c. for Oct. 31. Production at rate of 4,500,000 lb. per year and is increasing.

MEXICAN (Globe)—Shields, Medlin & Munday leasing on this old silver property, 6 mi. east of Globe, report opening high-grade streak of silver ore.

OLD DOMINION (Globe)—Making plans for installation of reverberatory and roasting plants; H. H. Colley, now in charge of smeltery and mill.

INSPIRATION (Miami)—Hoisted in August 490,000 tons of ore, from which approximately 11,000,000 lb. of copper was recovered. Live Oak tunnel leading to churn-drill area going slowly, account heavy ground.

Mohave County

U. S. GEOLOGICAL SURVEY has sent L. F. Biggs into Oatman district to begin preliminary work for geologic map of district.

TOM REED (Oatman)—Shaft on Red Cloud claim, wholly surrounded by the United Eastern, is down about 520 ft. Orebody recently struck in Aztec claim crosscut for 18 ft. and reported to average $14.67.

Pima County

BLUEBIRD AND JUMBO GROUPS in Ajo district sold to Oklahoma men through W. B. Batson of Tucson; development by churn drills planned.

Yavapai County

MONTEZUMA (Crown King)—Being financed by Colorado Springs investors; flotation plant to recover zinc, lead, gold and silver being planned; camp buildings being erected; J. P. Waldron in charge.

BEE HIVE GOLD (Congress Junction)—New organization formed by Charles Zeiger, of El Paso, to develop and operate group of nine patented gold claims, 12 mi. east of Congress Junction; developed by 3,000 ft. tunnels, drifts and raises; equipment, houses for 50 people, boarding house, commissary, shops and offices, compressor, Jackhamers and hoisting engine.

CALIFORNIA

Amador County

ARGONAUT (Jackson)—Expected that new milling installation will be in operation by 1917.

CENTRAL EUREKA (Sutter Creek)—Shaft repaired and sump cleaned out preparatory to sinking below 3,200 level. New drilling machinery to be installed.

CONSOLIDATED AMADOR (Sutter Creek)—Water lowered and shaft repaired to 650-ft. point. Grading for new steel headframe and hoist nearly completed. The 56-in. circular saw installed.

PLYMOUTH CONSOLIDATED (Plymouth)—Supt. James F. Parks reports for August: Milled 10,600 tons, total value, $57,585. Working expense $25,280; development, $9,838; surplus, $22,467. Other capital expended $7,319.

Calaveras County

ECLIPSE (Mokelumne Hill)—W. H. Morrison and J. Miller, of Stockton have begun work on this old gravel mine in Chili gulch, owned by A. H. McCarty. Machinery for washing gravel and saving black sand will be installed. Gold is coarse, with some $2 to $10 nuggets.

Eldorado County

ROCKY BAR (Fairplay)—Reported sold to Omer Denny and L. P. Denny. Property equipped with gravel-mining machinery.

PYRAMID (Placerville)—Old 500-ft. shaft retimbered; will be deepened 200 ft. before starting levels. Property well equipped. Charles Evans, superintendent.

BADGER HILL (Placerville)—This deep gravel mine in Camino district being reopened after idleness of 22 years, by Bryant Koch and Wood. Tunnel has been cleaned 200 ft.; new 600-ft. tunnel will be driven.

Mariposa County

PENN (Campo Seco)—Suits by 33 farmers for alleged injury to crops by the smeltery were dismissed on Sept. 18.

Modoc County

HESS (Alturas)—Stamps again dropping on free-milling ore from 20-ft. vein. Depth of mine less than 200 ft. Irving Clint, superintendent.

Nevada County

UNION HILL (Grass Valley)—High-grade scheelite encountered; only property in district in which tungsten has been developed.

EMPIRE (Grass Valley)—Recent completion of new 60-stamp mill it is stated will be followed by combination of present two concentration plants into one, and dismantling of Pennsylvania mill and cyanide plant. New construction to include about 1-mi. of electric road.

Placer County

GLENN (Auburn)—Main gravel channel encountered after two years of prospecting. About 20 years ago an upper channel produced $40,000. F. A. Moss and associates are owners.

GOLDEN STREAK GOLD MINING CO. (Colfax)—Incorporated to operate property in Iowa Hill district; directors are Henry Lobner, F. H. Schulze, F. D. Kuenzley, P. W. Crider and Walter Schulze, of Colfax.

San Bernardino County

CALIFORNIA TRONA (Trona)—Claims of H. E. Lee against this company's Searles Lake locations dismissed by Judge H. T. Dewhirst on Sept. 14.

Shasta County

GOLD LEAF (Redding)—Property near Middle Creek has resumed production. Ore hauled by team to Redding and shipped to Kennett.

MAMMOTH COPPER (Kennett)—Site for new $350,000 electrolytic-zinc plant is being prepared on Big Back Bone Creek, about one-half mile above the copper smeltery. Expected plant to be in operation in six months. Plant will operate on zinc byproduct from the copper baghouse. Herbert Hanley will be superintendent.

COLORADO

Boulder County

LOGAN (Crisman)—A 25-ton flotation plant will be built.

BLACK CLOUD (Salina)—Mill purchased recently by Denver men and will be remodeled into flotation plant.

PRIMOS (Lakewood)—Hoisting engineer killed recently by explosion of 10 sticks dynamite while adjusting primers.

Lake County

VALLEY (Leadville)—Large body of oxidized-iron ore, containing considerable silver and manganese, opened on 150-ft. level below adit on Prospect Mountain. Discovery considered important as ore is similar to that found in first contact on Fryer, Carbonate and Breece hills.

Saguache County

RALEIGH (Bonanza)—Mine has large body of complex sulphide ore. Three-compartment raise being driven from 1,200- to 600-ft. level. Tramway will be built from portal of haulage tunnel, where mill will be built, to Shirley station on Denver & Rio Grande R.R., to handle concentrate. Lower tunnel is 6,000 ft. in length.

San Juan County

SHIPMENTS FROM SILVERTON of ore and concentrates during August: Davey Leasing Co., 61 cars; Sunnyside, 35; Gold King, 32; S. D. & G. Leasing Co. and Silver Lake, 25 cars each; Iowa-Tiger, 18; St. Paul, 10; Mears-Wilfley and Barstow, 8 cars each; Whale Lease, 6; Highland Mary, 5; Silver Ledge, Genesee, and Kopei Leasing Co., 3 each; Dives, Congress, Morgan, and Andrene & Jackson, 2 each; Joker Tunnel, Reno Leasing Co., Hudson, Carbonate King, Pride of the West, Big Giant and Intersection, one car each; total 257 cars. Cars averaged about 22 tons each, or a total of about 5,654 tons.

QUEEN CITY (Silverton)—Rich lead-silver ore opened in this Ohio Creek property.

SILVER LEDGE (Chattanooga)—Mill running steadily. Concentrates shipped to Durango smelting plant.

PRIDE OF THE WEST (Silverton)—Bertoldi & Giono sold their lease and bond to New York men. A. W. Harrison now in charge.

SILVER LAKE MILL (Silverton)—During August treated 1,628 tons of custom ore from following properties: Little Dora, 26 cars; Congress, 16; Green Mountain, 10; S. D. & G. Leasing Co., 7; Genesee, 4; Champion and Atlantic, 3 each; Detroit & Colorado and St. Paul, 2 each; and Barstow, one car; total 74 cars.

San Miguel County

SHIPMENTS FROM TELLURIDE during August were: Tomboy, 45 cars; Smuggler-Union and Black Bear, 32 cars to Durango and 20 cars to Blende; Liberty Bell, 19 cars; Columbia, 2; Anderson, 1; total 129 cars, mostly concentrates.

FOURTH OF JULY (Sawpit)—Being developed by Ouray men; payable ore opened.

BLACK BEAR (Pandora)—Mine buildings being improved preparatory to winter operations. Shaft will be enlarged and skip will replace bucket now in use.

MELDRUM UNITED TUNNELS CO. (Telluride)—Stockholders' meeting elected W. E. Wheeler, president, and decided upon active development in near future.

MOODY (Vanadium)—Payable silver-lead ore opened in this property about 5 mi. from Vanadium. Oreshoot cut by 6-ft. winze near breast of 550-ft. development drift.

OPHIR GOLD MINES AND REDUCTION CO. (Ophir)—New incorporation to develop Belisle and Sankey gold and molybdenum properties near Ophir. Directors are C. M. Goddard, of Denver; J. M. Belisle and N. Sankey, of Norwood.

WAGNER DEVELOPMENT (Telluride)—Company purchased milling and tramway equipment of Junta Consolidated in Bear Creek, and will remove to Alta property it is operating in Gold King Basin.

Summit County

AUGUST GOLD PRODUCTION of Breckenridge estimated to be $80,000. Four dredges now working. These, with Dunkin mine, are largest producers of gold in district.

TOMSON (Robinson)—Strike of ruby silver near Columbia lease.

KIMBERLY (Robinson)—Concentrating mill to be put in commission soon.

MICHIGAN (Robinson)—Car crude ore being shipped daily in addition to ore sent to mill.

ALSATIAN (Breckenridge)—This silver mine at head of McCullough Gulch being reopened.

JESSIE (Breckenridge)—Development work under way; 16 men working. Small shoots gold-zinc ore opened.

ONEER CONSOLIDATED (Breckenridge)—Purchased 160 acres on Gibson Hill, including Little Corporal group, Cleveland lode and Ophir placer. Some of the dumps will be treated in Extension mill, now being overhauled.

WELLINGTON (Breckenridge)—In August shipped 95 cars ore and concentrates. One car crude zinc ore per day shipped; ore assays nearly 50% zinc and comes from fifth or deepest level. New adition to dry mill nearly completed; this will add materially to production of concentrate. Sallie Barber mine unwatered, and mining under way.

Teller County

LITTLE DAISY (Cripple Creek)—Operations to be resumed on this Bull Hill property.

MODOC MINING AND MILLING CO. (Cripple Creek)—Three cars ore being shipped weekly.

IDAHO

Idaho County

INTERNATIONAL (Orogrande)—Development in progress by Spokane men. Mill may be installed. Frank Sockolich in charge.

UNA GOLD MINING CO. (Orogrande)—A 1,020-ft. crosscut tunnel being driven to tap orebody at depth of 300 ft. Manager, Ralston McQuaig.

GOLD DROP (Elk City)—Installation of 15-ton experimental mill completed. New hoisting machinery being installed. H. L. Herkelroth, owner.

ELK CITY GOLD DREDGING (Elk City)—M. A. Lungo is making inspection of company's 380 acres of placer ground. May start present small dredge and install larger boat in near future.

Shoshone County

FIRST REGULAR SHIPMENTS TO ANACONDA from the Douglas zinc-lead mine in Pine Creek began Sept. 19; comprised 400 tons high in zinc; Anaconda's royalty on this ore is $3 per ton. Ore is milled at Anaconda and concentrates treated at new electrolytic zinc plant at Great Falls, Mont. Option extended six months and new machinery ordered to expedite development.

SILVERADO (Mullan)—In raise from 4,000-ft. tunnel, gray copper ore was opened in vein 6 to 9 ft. wide. All machinery for 100-ton mill on ground or en route.

IDAHO-NEVADA (Wallace)—Will soon ship car of copper ore from this Placer Creek property. Enlarging shaft station for new hoist. May install electric pump. A. D. Marshall in charge.

VIENNA-INTERNATIONAL (Wallace)—Compressor to be installed at this Placer Creek property under bond to F. C. Bailey, of Spokane. Encouraging ore showings. W. B. Lively, superintendent.

HECLA (Burke)—Will increase its mill capacity at Gem 200 tons per day; present capacity, 450 tons. Other improvements include new change house, addition to mine bins and new sorting plant.

RAINBOW MINING AND MILLING (Wallace)—At the No. 2 property on Little North Fork, two shifts are driving main tunnel, now in 350 ft. Some silver-lead-zinc ore encountered but tunnel objective is from 300 to 500 ft. farther.

MICHIGAN

Copper

CHEROKEE (Houghton)—Shaft being sunk in the lode, is down 80 ft.

WHITE PINE EXTENSION (Ontonagon)—Shaft down 230 ft. Crosscutting to lode.

VICTORIA (Victoria)—New shaft down to 24th level; employing 300 men. Mill handling 450 tons daily; eight new tables to be added.

OSCEOLA CONSOLIDATED (Osceola)—Old Osceola section of property supplying only about 600 tons per day. Kearsarge sections have increased tonnage to 4,200 tons daily.

Iron

AT NEGAUNEE, a large cave of ground occurred recently on the Mary Charlotte and Rolling Mill properties; ground had been fenced off as it was known it would cave. The hole is about 200 ft. long and 75 ft. wide; capping went into abandoned workings.

NEWPORT (Ironwood)—New Woodbury shaft now being concreted. Will not be ready for use until after first of year.

SECTION 21 (Ishpeming)—Some ore to be shipped from piles that have been in stock for years. Mine, idle for some time, may resume.

JONES & LAUGHLIN (Ishpeming)—Orders received to ship 35,000 tons from Iron Mountain pit, idle several years. Ore is low grade.

ATHENS (Negaunee)—Shaft down nearly 2,000 ft. Averaging about 150 ft. per month. Shaft will be over 2,600 ft. when bottomed. Will be deepest iron-mine shaft in Lake Superior district. Permanent hoisting equipment being used in sinking.

CLEVELAND-CLIFFS IRON (Ishpeming)—New water power plant on Dead River in commission. About 1,200-hp. is sent to Maas mine station for distribution. Company's other plant furnishes about 5,000 hp. Still more will be needed when mines now being developed are ready to start mining.

MINNESOTA

Mesabi Range

SHENANGO (Virginia)—New steel headframe installed.

SILVER (Virginia)—Electric haulage recently installed underground.

ALPENA (Virginia)—Three shifts now being employed; many of old crew are back.

CLARK (Chisholm)—Mine working again with two shifts. About 900 tons being hoisted daily.

JEAN (Eveleth)—Property to be stripped by Roberts & Kingston for Kingston & Co.

SHIRAS (Buhl)—With resumption of operations here, every mine in Buhl district now working. Crews being increased daily.

CHISHOLM (Chisholm)—Operations cannot be resumed here until Jan. 1. Shaft is being concreted; delay in getting steel sets and girders.

HARTLEY (Chisholm)—Operations to be resumed in pit shortly. Mine closed down five years. Equipment being overhauled. Not much ore can be shipped before close of navigation.

HARRISON (Nashwauk)—Mine developing into large shipper; five shovels in pit. Concentrating plant is working two shifts. Shipments from this mine and the Kevin, operated in conjunction with the Harrison by Butler Brothers, amount to as high as 12,000 tons a day.

WEBB (Hibbing)—Washing plant for underground ore is operating, after some weeks of experimentation; capacity 75 tons an hour. Mine comprises three 40-acre tracts; one is completely developed underground and the other 40 will also be developed by this method, the ore to be trammed to present shaft. One shovel is stripping another 40; Winston-Dear Co. has excavating contract.

MISSOURI

Joplin District

BIX SIX (Joplin)—Sunk new shaft 110 ft. in seven weeks. Drill holes showed ore from 117 to 138 ft.

MERCHANTS (Commerce, Okla.)—Starting shaft after sinking five drill holes, showing ore at about 200 ft.

BRYAN & CO. (Joplin)—Started coal mining in Continental Zinc Co.'s zinc-lead tract. Getting out about 30 tons of firm, soft coal daily.

KANSOURI (Blue Mound, Kan.)—Sinking shaft on Chubb land, following thorough drilling. Ore face 18-ft. thick indicated at 225 ft.

BLOUNT & CO. (Commerce, Okla.)—Arranging for new mill on tract recently drilled out. Sixteen holes showed good formation; last hole 8 to 27% of blende.

ADIRONDACK (Joplin)—Constructing 300-ton mill on city's land. Two shafts now being put in shape, third being started. Two more will be put down later. Pittsburgh, Penn., men principally interested.

Northern Arkansas

MORNING STAR (Rush)—Operations resumed after two weeks shut down. Recent strike above old Star tunnel continues in good ore.

ARKA-HOMA (Rush)—Planning two new mills, one on Eureka Hollow mine at Tomahawk and other at Bing End on Panther Creek; will use oil engines.

MONTANA

Beaverhead County

BANNACK GOLD (Bannack)—New concentrator, nearing completion, will have capacity to treat all ore from the several groups owned by company. Mill largest in Beaverhead County.

Broadwater County

BLACK FRIDAY (Radersburg)—This gold property will be operated by Breitung & Co., Ltd., of 11 Pine St., New York. Mine is being pumped out.

Madison County

IN SUMMIT DISTRICT AROUND VIRGINIA CITY, some exceptionally rich streaks of gold ore have been encountered recently. High-grade samples taken from the Raine and from the Summit Development Co.'s property, which includes the Shafter mine. Activity in the old camp increasing daily and there are prospects of a brisk revival.

Silver Bow County

BUTTE & GREAT FALLS (Butte)—Purchased Snowdrift and Rio Tinto claims adjoining company's property; being explored on 500 level by diamond drilling. Sinking will be carried to 1,000 level. The 700-ft. crosscut has opened several well mineralized veins.

BUTTE & SUPERIOR (Butte)—According to report filed in Federal court in connection with Minerals Separation litigation, company treated 31,733 tons of ore in its flotation plant during August, producing 7,502 tons of concentrates at a cost of $4.89 per ton of concentrates; value, $49.45 per ton.

NEVADA

Esmeralda County

REORGANIZED CRACKER JACK (Goldfield)—Several feet of excellent ore reported in raise from south drift on 120-ft. level.

REORGANIZED BLACK BUTTE (Goldfield)—Purchased 6-in. core drill to prospect property at depth. Mine workings now 350 ft. deep. Past production about $500,000 gross.

JUMBO EXTENSION (Goldfield)—Preliminary estimate for August shows 2,443.65 dry tons shipped, gross value $72,000. Freight, treatment and sampling $26,500; smelting losses $7,000; operating costs $15,500; net realization $23,000.

Nye County

TONOPAH ORE PRODUCTION for week ended Sept. 16 was 9,247 tons valued at $192,326 compared with 8,134 tons for week previous. Producers were: Tonopah Belmont, 2,924 tons; Tonopah Extension, 2,200; Tonopah Mining, 2,100; West End, 769; Jim Butler, 750; Halifax, 210; Rescue-Eula, 162; North Star, 55; miscellaneous, 86 tons.

TONOPAH MINING (Tonopah)—Profit for August, $59,570 from treatment of 8,098 dry tons averaging $15.50 per ton and yielding 140,185 oz. bullion valued at $120,555.

TONOPAH EAST END DEVELOPMENT CO. (Tonopah)—Stockholders ratified agreement by which Tonopah Belmont acquires 51% of stock, leaving 300,000 shares in treasury, in consideration of expending $50,000 in development. Claims lie about two miles easterly from Belmont mine.

TONOPAH WESTERN CONSOLIDATED MINING CO. (Tonopah)—Recently incorporated to develop area between Tonopah Bonanza on the north and Great Western Consolidated on the south. Contemplate development from Great Western shaft. Area embraces about 650 acres, 2 mi. westerly from Tonopah Extension mine.

Storey County

CON. VIRGINIA (Virginia)—West crosscut 2,700 level advanced 15 ft. to 105-ft. point, passing through vein porphyry.

MEXICAN (Virginia)—Old west crosscut, 2,500 level, reopened to 110-ft. point. Mexican mill received 578 tons custom ore, average assay $17.27.

UNION CONSOLIDATED (Virginia)—Ore extraction 465 tons, from 2,400 and 2,500 levels: 149 tons, $29.13; 114 tons, $10.68; 51 tons, $12.61; 50 tons, $11.40; 55 tons, $10.01; 46 tons, $13.61.

SIERRA NEVADA (Virginia)—Raise in northwest drift on 2,400 level extended 16 ft., top in ore averaging $30. Saved 30 tons ore from extension of raise, averaging $16; saved 82 tons, averaging $12.34 from south boundary line stope. North drift on 1,500 level cleaned out to 250-ft. point; east crosscut, 2,600 level, advanced 12 ft.

White Pine County

CONSOLIDATED COPPERMINES (Kimberly)—About 60 men working on remodeling of old Giroux mill into flotation plant. Callow cells being installed. Walker J. Boudwin is in charge for the General Engineering Co. which has the contract.

NEW MEXICO

Socorro County

OAKS CO. (Mogollon)—Operating Clifton-Eberle group; making regular shipments to custom mill of ore taken from development; no stoping to date.

EUREKA (Mogollon)—D. E. Bearup encountered high-grade ore in No. 3 tunnel. First-grade ore being sacked for shipment to smeltery; second-class treated in local mills.

GOLD EAGLE (Mogollon)—Work resumed by owner, Louis Gramas. About 400 ft. of tunnels and 80 ft. of shafting has been done. Denver men relinquished bond owing to lack of funds.

MOGOLLON MINES CO. (Mogollon)—Milled 4,200 tons ore in August; shipped 3,100 lb. gold and silver bullion and several tons concentrates. Station being cut for 900-ft. level in new shaft and sinking will be continued when completed.

PACIFIC (Mogollon)—At this mine, operated by Socorro Mining and Milling Co. under agreement with the Oaks Co., carpenters are completing loading station and terminal for aërial tramway to Socorro mill, at which end construction is practically complete. All intermediate towers are in place and cable and other equipment on ground. Line will deliver 75 tons of ore daily to mill. Sinking of shaft below the 500 is in progress.

SOCORRO MINING & MILLING CO. (Mogollon)—Bullion production for August was approximately 70,000 oz. gold and silver and a quantity of concentrates which go to smeltery at El Paso. Company has adopted elevator-and-conveyor system to dispose of mill tailings, but installation is delayed by equipment having gone astray in transit. At the Johnson mine new shaft has reached depth of 200 ft., in ore most of distance. O. L. Walker, chemist, is making flotation tests on various ores of the camp; ores in northern end of district susceptible to this treatment.

UTAH

Beaver County

CEDAR-TALISMAN (Milford)—At meeting held Sept. 15, resignation of H. S. Joseph, managing director, accepted; and G. L. Bemis appointed director. Lead-silver as well as zinc ore being mined.

Juab County

TINTIC SHIPMENTS for week ended Sept. 14 amounted to 193 cars, largest tonnage in some time.

COLORADO (Silver City)—Station being cut on 1,500 level, where prospecting will be done before further sinking is attempted.

EUREKA HILL (Eureka)—Dividend of $1 per share declared Sept. 13, on 10,000 shares outstanding. Operations carried on by lessees only.

GRAND CENTRAL (Eureka)—Electricity to be used for hoisting. Equipment similar to that at the Eagle & Blue Bell will probably be installed.

RIDGE & VALLEY (Eureka)—Drifting and crosscutting being done on 1,500 level. Winze being sunk to 1,700. Small electric hoist to be installed here.

GEMINI (Eureka)—Rich shipment of silver ore by lessees from 1,400 level. Returns expected to be between $13,000 and $14,000; company to receive 50% royalty.

EUREKA MINES (Eureka)—Development being done through 1,300 level of Gemini. Several stringers and benches of lead ore cut. Property recently incorporated. Jackson MacChrystal manager.

DRAGON CONSOLIDATED (Silver City)—Sinking from 500 to 900-ft. level, at north end of property, near Iron Blossom line. Large shipments of iron ore being continued; siliceous ore shipped to Tintic mill.

SIOUX CONSOLIDATED (Eureka)—Contract for sinking main shaft given to Duncan & Allen; three shifts will be used in sinking to 1,000-ft. level. Winze on 600 level being sunk in search of continuation of Iron Blossom copper deposits.

Piute County

WEDGE (Marysvale)—Developing at this gold property in Horse Heaven section of camp.

SHAMROCK (Marysvale)—No. 3 tunnel, Bullion Cañon now in 170 ft.; objective 210 ft. Work being done by hand drilling.

Summit County

PARK CITY SHIPMENTS for week ended Sept. 14 amounted to 3,170,280 lb. of ore and concentrates; Silver King Coalition largest shipper. Corrected shipments for August given at 9,072 tons.

REVELATOR (Park City)—Six inches of good ore opened at this Snake Creek property.

ONTARIO (Park City)—Shipments of dry silver ore, restricted by accumulation at smelteries, have been resumed.

SILVER KING COALITION (Park City)—Much better saving being made since installation of new flotation equipment.

DALY (Park City)—Good ore opened in several places. Property recently inspected by George D. Blood. Walter Harris, superintendent.

BROADWATER MILL (Park City)—Three week's test run completed Sept. 11, under direction of M. H. Kuryla. Thought probable some changes will be made in mill, and work resumed. Large accumulations of tailings to be treated if profitable.

CANADA

Ontario

KENZIE (Elk Lake)—Operations have been resumed with E. C. Taylor in charge.

SMITH (Munro)—These claims adjoining the Crœsus sold to Montreal-Toronto syndicate.

GIFFORD (Cobalt)—Winze is now 100 ft. below the 200-ft. level on a wide calcite-quartz vein.

MILLER INDEPENDENCE (Boston Creek)—Hardinge ball mill of 45 tons daily capacity and flotation plant of 80 ton capacity ordered.

KING DODDS (Kowkash)—Tash-Orn Gold Mines, Ltd., which owns 14 claims at Tashota, has secured controlling interest in this property.

HUDSON BAY (Cobalt)—Two veins recently found on surface greatly improved with stripping. One shows 4 in. of high-grade ore estimated to contain 4,500 oz. silver per ton.

INTERNATIONAL MOLYBDENUM CO. (Orillia)—The first ferro-molybdenum produced commercially in Canada was run Sept. 21. One electric furnace running steadily and two others will shortly be in operation.

MEXICO

SIXTEEN AMERICAN MINING COMPANIES dispatched Sept. 26 to Franklin K. Lane, chairman of the American division of the Mexican-American Commission in session at New London, Conn., a joint protest concerning confiscatory taxes in Mexico and destruction of property and life by raiders. The protest was prepared by William Loeb, Jr., a director of the American Smelting and Refining Co. and signed by officials of 15 other mining companies. The tax of 13% on gross value of ore mined and threatened confiscation in the event of suspension was especially protested against. Conditions in Mexico are stated to have grown worse instead of better and the de facto government unable to maintain order. Prime requisites to the resumption of operations, according to the statement, are: Protection from bandit raids on life and property; reduction of present excessive taxation; permission to buy Mexican currency at its market value; the discontinuance of labor control by government decree; permission to import food for employees; better transportation facilities; better sanitary conditions and a concerted campaign against disease.

CUBA

DAVISON CHEMICAL CO., of Baltimore, U. S. A., understood to have $1,500,000 bond issue in contemplation to finance building of railroad to the Carlotta cupriferous pyrite deposit it is developing in Santa Clara province, about 18 mi. north of Cienfuegos.

POTASH DEPOSITS near Motembo, along boundary of Matanzas and Santa Clara provinces, reported in series of wild cablegrams to New York "Times" from Habana. Followed in five days by advertisements of stock offerings in Cuban Potash Corporation. Potash content supposed to range from 12 to 40%, and 10,000-acre tract optioned. No confirmation available at this time from dependable sources.

The Market Report

Metal Markets

NEW YORK—Sept. 27

The outstanding feature of the week was the sale of an enormous quantity of copper to the agents of the Allied Governments. This having been consummated, the copper market became dull. Lead was active at unchanged prices. Spelter was dull and a little weaker.

Copper, Tin, Lead and Zinc

Copper—The expected sale of a very large quantity of copper to the agents of the Allied Governments was concluded on Sept. 23, and was immediately announced. The quantity was 200,000 long tons—448,000,000 lb. Delivery is to be during the first half of 1917. Price has not been specifically stated by any of the parties to the transaction, nor have any further details. Nearly all of the principal selling agencies participated in the business. It appears that the transaction was negotiated by the agency of the British Munitions Ministry with the Anaconda Copper Mining Co. and the American Smelting and Refining Co. Participations were offered to other selling agencies to such amounts as desired by them, the principal agencies undertaking to furnish such quantity to make up the round lot as was not arranged for otherwise. The total transaction is estimated as covering about one-third of the expected production of American refiners in the first half of 1917. Certain producers participated in the sale exactly to the extent of one-third of their expected output. Inasmuch as some agencies and producers did not participate, others must have contracted to deliver more than one-third of their output.

Even before the consummation of this transaction, the copper market became dull and after its announcement became very dull, contrary to expectations in many quarters. It became evident then that the large domestic transactions of the previous fortnight had been anticipatory. The business of last week whereof we had reports was a little less than 18,000,000 lb., compared with about 60,000,000 lb. in the previous week. This business was again chiefly for domestic account and was done at a wide range of prices, the average being 26.73c., cash, New York. Copper for October-November delivery exists no longer except as trifling quantities in second hands, and with one or two small producers. Occasional sales of lots of 100,000 lb. or so were made at 28½c., r.t. A moderate quantity of December copper was sold at 27½c., r.t., equivalent to 27¼c., cash, New York. The bulk of the business was for delivery during the first half of 1917, this taking the form of contracts for first quarter, second quarter, or first half.

The supply of copper available for delivery by producers during 1916 is now nearly zero and the market for that delivery is but nominal. There are some important consumers who have failed to cover their requirements and are desirous of buying million-pound lots. It is estimated in authoritative quarters that less than 25% of the expected production in the first quarter of 1917 remains unsold.

Copper exports from Baltimore for the week included 3,072,760 lb. to Archangel, Russia; 249,972 lb. copper and 389,339 lb. brass to Marseilles, France.

Copper Sheets are nominal at 37.5c. per lb. for hot rolled and 38.5c. for cold rolled. Copper wire is 32@32½c. per lb. for large lots at mill. These prices are mostly nominal; as already explained much sheet and wire business is now done on a toll basis.

Tin—There was but little change in this market. There was fairly good business for future delivery, but the near-by position continued dull and depressed.

Lead—Some large and attractive offers developing on Sept. 21, business was done in large volume by several producers at a small concession in price, but thereafter all of the business on New York basis was reported done at 7c., save for an occasional stray lot. The St. Louis market fell into more regular step with New York. The lead position is very strong, but little lead for October delivery remains that has not already been pre-empted. Some very interesting export business has been done during the last wek.

Spelter—This market was very dull and a little weaker, but toward the close there was a firmer tone, and, indeed, an increased volume of business.

Opinions among zinc producers are divergent. The optimists look for an improvement in price, arguing that the recent large purchases of copper must herald large requirements for spelter. The pessimists admit that that may be so, but point out that the buying of spelter may be carried on month by month up to the middle of next year, just as it has been done of late, and point out further that the American production has probably not yet attained its maximum. It is admitted that numerous uneconomical producers have blown out, but in the main they were small ones, and the older, more important producers are still making extensions of plant. Thus important additions to Hillsboro and Rose Lake are in construction. The production of electrolytic zinc is also making headway.

The Donora Zinc Works now has all of its 10 furnaces in operation.

Exports from Baltimore for the week included 168,094 lb. spelter to London.

Zinc Sheets are in steady demand and business is fair. Quotations are unchanged at $15 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

NEW YORK—Sept. 27

Aluminum—Demand continues good and available supplies do not increase. Prices are a shade firmer, No. 1 ingots being quoted at 62@63c., New York. Contract deliveries are slow.

Antimony—This market continued dull and weaker. We quote 10½@11½c.

Quicksilver—The price was unchanged at $75, New York, fair business reported done. San Francisco reports, by telegraph, $75, market strong.

Nickel—Demand is good both from domestic and export business. Prices are firm and unchanged at 45@50c. per lb. for ordinary forms, according to size of order. A premium of 5c. per lb. is charged for electrolytic nickel.

An export of 1,900 tons nickel to Russia is reported this week.

Minor Metals—Current quotations for **Bismuth** are $3.15@3.30 per lb., New York.—**Cadmium** is quoted at $1.45@1.50 per lb.—**Cerium**, electrolytic, is sold at $8@9 per lb.—**Cobalt Metal** is quoted at $1.25 per lb.—**Magnesium** is steady, with sales at $3.75@4 per lb. for 99% pure—**Selenium** is from $3 up to $5 per lb., according to size of order.

Gold, Silver and Platinum

NEW YORK—Sept. 27

Gold—The Department of Commerce reports the total imports of gold into the United States for the eight months ended Aug. 31, 1916, at $290,325,463; exports, $93,581,157; net imports, $196,744,306. The August imports were $41,238,718; exports, $11,780,000; leaving $29,458,798 as the net imports. The largest imports this year were in June, when $122,734,730 came in.

Silver—The market continues steady and as visible supplies have not increased the tone of the market continues good, with offerings being absorbed at current figures.

Mexican dollars in New York were quoted on Sept. 21, 22 and 23 at 53⅛@56c.; Sept. 25, 26 and 27 at 53⅜@56⅜c. Prices showed very little variation during the week, and there was only a small demand.

Platinum—There was a sharp advance in price on brisk demand from jewelry manufacturers. In the early part of the week sales were made at $86, and in the latter part, at $90. We quote $88 as the average for the week.

Zinc and Lead Ore Markets

Platteville, Wis., Sept. 23—Quotations of the district are according to the following figures: Base price per 2,000-lb. ton for material assaying 60% zinc is $58 for premium ore down to $50 for medium grade. For material assaying 80% lead the base price per 2,000-lb. ton is $74. Shipments for the week were 3,291 tons of zinc ore, 174 tons of lead ore, and 1,283 tons of sulphur ore. For the year to date, the figures are 90,758 tons of zinc ore, 3,233 tons of lead ore, and 22,073 tons of sulphur ore. Shipped during week to separating plants, 3,055 tons of zinc ore.

Joplin, Mo., Sept. 23—Price quotations per 2,000 lb.: Blende, high, $64.85; 60% zinc, premium ore, $65; medium grades, $63@60; low, $55. Calamine, per ton 40% zinc, $45@35. Average selling price, all grades of zinc, $55.47 per ton. Lead, base price, $70@75 per ton, 80% metal content; high price, $72.30; average selling price, all grades of lead, $68.99 per ton.

Shipments of the week: Blende, 7,667 tons; calamine, 662 tons; lead, 1,254 tons. Value, all ores, $548,590 for the week; the year to date, $27,653,590.

With a stronger demand and higher base being paid, the greater tonnage of medium to low grades of blende shipping reduces the average value per ton. Some quite low-grade calamine shipping is offset in average value by a larger tonnage of best grades, and this average is advancing.

A second week of heavier tonnage shipment increases the situation here by lowering the stock in the bins. During the past week mines dependent upon hydroelectric power were idle several

SILVER AND STERLING EXCHANGE

Sept.	Sterling Exchange	Silver: New York, Cents	Silver: London, Pence	Sept.	Sterling, Exchange	Silver: New York, Cents	Silver: London, Pence
21	4.7575	68⅞	32⅜	25	4.7575	69¼	32 1/16
22	4.7575	68⅞	32⅜	26	4.7575	69¼	32 1/16
23	4.7575	68⅞	32¼	27	4.7575	69¼	32 1/16

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Sept.	Copper: Electrolytic	Tin: Spot.	Lead: N. Y.	Lead: St. L.	Zinc: St. L.
21	26½ @27	38½	6.90 @7.00	6.75 @6.92½	8.87½ @9.12½
22	26½ @27	38½	7.00	6.82½ @6.92½	8.87½ @9.12½
23	26½ @27	38½	7.00	6.82½ @6.92½	8.75 @9.00
25	26½ @27	39	7.00	6.82½ @6.92½	8.62½ @8.87½
26	26½ @27	38¾	7.00	6.82½ @6.92½	8.75 @9.00
27	26½ @27	39	7.00	6.82½ @6.92½	8.75 @9.00

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only St. Louis price is given, St. Louis being basing market. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Sept.	Copper: Standard Spot	Copper: Standard 3 Mos.	Copper: Electrolytic	Tin: Spot	Tin: 3 Mos.	Lead	Zinc
21	116½	113	136½	173	173½	30¾	55
22	116	113	136½	171½	171½	30½	54
23	....	....	....	....	....	....	....
25	116	113	136½	172	172½	31½	52
26	116	113	138	172	172½	31½	52
27	116½	113½	138	173	173¼	31½	52

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. Copper quotations for electrolytic are subject to 3% discount. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜ cents.

days during the installation of an additional turbine to increase the units of power. Otherwise conditions are improving, with mills gradually increasing their outputting capacity.

OTHER ORES

Manganese Ore continues steady at around 65c. per unit for Brazilian and Indian ores. The same price is paid for domestic ores, 45 to 50%. The quantity of domestic ores offered is not large.

Imports at Baltimore for the week included 11,100 tons of manganese ore from Brazil.

Antimony Ore—Sales reported at $1@1.10, and a small quantity for special purposes at $1.60 per unit.

Tungsten Ore—This market was substantially unchanged, sales being made at $16@17 per unit.

Charles Hardy makes the following interesting report: "The market has shown considerably more interest and the inquiries for ores from the home users have been more numerous than they have been for the last two or three months. Further quantities were booked for shipment abroad and the quantities required for Europe seem to be still very great as the agents for the Allies have now appeared again in the South American market with a view to buy direct there. Business has actually been done in Argentina for direct shipment to France, and in the other market negotiations are still continuing. Business with England is still impossible on account of the low prices fixed there by the minister of munitions for ferro-tungsten, 5s. 6d. per lb. and over, tungsten powder, 6s. 3d. per lb.; this corresponds approximately with $1.20@1.48, American currency and at these prices the American manufacturers would compete in that market. France, Italy and Russia, however, who have no sources of supply for the ore have to fix higher prices and are therefore the only Allied countries which are now buying ores in this market."

Iron Trade Review

NEW YORK—Sept. 27

The iron and steel trades show no decrease in activity. The mills are taking in business in excess of their deliveries and the question is how they can fill their orders.

Export business is offered freely; in fact the question is how much can be taken. It seems as if Europe would buy any quantity of steel that the mills can furnish. Domestic orders are on the increase as manufacturers are now looking forward to supply their needs for iron and steel in the first half of 1917. It seems to be more a question of deliveries than of prices. The pressing demand is for plates and shapes for shipbuilding and car building. The activity in the shipyards is augmented by new orders, so that there is no sign of decrease.

Light rails are in unusual demand and the mills making them are utilizing discard steel, of which large sales were recently made, and which is well adapted for this purpose.

The pig-iron market is strong and active and prices generally are advancing. Both basic and foundry iron are in demand and some heavy contracts for basic running well into next year have been placed. There is a demand for bessemer and low phosphorus iron for export. Some people are debating a possible shortage of bessemer ores this winter.

A list of new openhearth steel plants completed in 1916 is published by the "Iron Age." It shows new plants having a total capacity of 2,700,000 tons of steel ingots yearly. Other plants with a capacity of 500,000 tons will be completed by the end of the year.

Scrap is in demand, especially heavy steel melting scrap, showing the activity of the basic openhearth steel furnaces. Prices are advancing.

The Carnegie Steel Co. is putting up installations for pulverizing coal at its Homestead and Clairton works. The object is to test the use of pulverized coal in the openhearth steel furnaces.

Exports from Baltimore for the week included 13,438,918 lb. steel rails and fastenings, 1,685,689 lb. steel billets and bars to France; 661,220 lb. steel beams, 749,852 lb. nails, 20,347,508 lb. steel billets and forgings to Great Britain.

National Association of Sheet and Tinplate Manufacturers has completed its organization and established offices in the Oliver Building, Pittsburgh. Walter W. Lower is secretary and treasurer.

PITTSBURGH—Sept. 26

The steel market is in the midst of another general advance in prices. All along the line prices are hardening and deliveries obtainable at base prices are placed farther in the future. A regular advance in bars, plates and shapes is predicted to occur within a fortnight, probably about $3 a ton, and an advance of $2 a ton is predicted for wire products, while the sheet market is hardening.

Buyers generally are showing more confidence in the future, and many jobbers, who recently were predicting that a break would occur in the market by this time, are now taking hold for next year. In sheets, which are not yet offered for next year, there has been some buying for this year's delivery against later requirements.

In steel for specific consumption there is greater demand. Following moderate purchases of cars in the past fortnight the railroads are out for at least 20,000 freight cars. There is inquiry for a total of 60,000 tons of plates, for the Sinclair Oil Co.'s pipe lines, 800 mi. of 6- and 8-in., and there is continued demand for ship steel. The new naval program of the United States involves about 200,000 tons to be let in about a month.

While the mills are confining their activities very largely to the booking of orders for specific tonnages and avoiding the making of open contracts for future specification, their bookings are exceeding their shipments and thus they are becoming sold farther and farther ahead. While two months ago it was regarded as optimistic to predict that the mills would operate at capacity through the first half of next year it now looks as though it will not be long until activity through the whole year is practically assured.

Steel production is increasing and is now at nearly normal rate, following the curtailed production of the hot weather.

Pig Iron—The pig-iron market has grown decidedly excited this week and prices are advancing rather sharply. The buying is somewhat heavier, but the change seems to be due chiefly to the sellers having had a fresh accretion of courage, while consumers feel that there is much less risk in taking hold than in staying out of the market. The gap between pig iron and steel prices is so very wide that buyers could afford to pay much higher prices for pig iron. Bessemer is very scarce, the output from now to the opening of Lake navigation next year being limited by the supplies of bessemer ores. There is no general shortage of pig iron in evidence at present or in immediate prospect, but some consumers are keeping themselves supplied by having producers anticipate shipments. While bessemer was quotable at $21, Valley, a week ago, sales of 20,000 to 30,000 tons have since been made at $22, and $22.50 is now demanded, with very limited offerings, and small tonnages have sold at this figure. Basic, which a week ago was quotable at 25c. advance to $18.25, Valley, has sold at $18.50 and is now held at $19, with limited offerings. Foundry is up 50c., partly in sympathy. We quote: Bessemer, $22.50; basic, foundry and malleable, $19; forge, $18.50, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Steel—On Sept. 20 the Carnegie Steel Co. made fourth-quarter prices to holders of long-term contracts for billets and sheet bars, the regular basis being $42 or $43 but with concessions to some consumers. The average advance over third-quarter prices is about $5 a ton. In the general market steel is hardly obtainable, but is quotable at $45@50. A sheet mill which makes steel itself has bought 1,000 tons of bessemer sheet bars at $45. Ordinary wire rods are sometimes available to regular customers at $55, prices ranging up to $90 for high carbon rods. The Inland Steel Co. is offering ingots at $36 or $37, Chicago, having a temporary surplus of steel making over blooming mill capacity.

FERROALLOYS

Spiegeleisen is active and firm in price, standard 20% manganese selling at $40@45 per ton at furnace; high grade, 25 to 30% brings $55@60 per ton.

Ferrosilicon, 50%, is firmer, and is quoted at $86@89 per ton at furnace according to size of order. Bessemer ferrosilicon ranges from $30 for 9%, up to $41 for 16%, all per ton at furnace.

Ferromanganese—The market is now steadier on contract, with imported at $164 and domestic at $165, it being held that deliveries are somewhat more certain on the latter, but the market is not very active. Prompt generally quoted $165@170 per ton.

FOREIGN IRON

New South Wales Pig Iron production in 1915 was 76,318 tons, an increase of 1,168 tons over 1914. The production was from Eskbank Furnaces at Lithgow. The material used was 134,684 tons of iron ore mined at Tallawang and Coombing; 96,316 tons coke; 42,379 tons limestone. The quantity of steel ingots made was 25,040 tons.

German Pig Iron Production in August is reported at 1,145,000 metric tons, being 11,000 tons more than in July. This brings the total for the eight months ended Aug. 31 up to 8,776,638 tons.

German Steel Production in June is reported by the German Iron and Steel Union at 1,319,762 metric tons, being 92,375 tons less than in May. For the six months ended June 30 the total make was: Converter steel, 3,830,559 tons; openhearth, 3,294,041; direct castings, 485,610; crucible, 52,920; electric, 85,797; total, 7,748,827 tons. This is an increase of 1,561,827 tons over last year.

Australia—The pig-iron production of the new works built by the Broken Hill Proprietary Co. at Newcastle, N. S. W., in 1915 was 120,000 tons; steel, 99,000 tons. The make of steel at present is 6,600 tons monthly and the company is adding four openhearth furnaces to its plant. A rolling mill for structural steel and light rails is also being added. With the new furnaces the company will be able to make 12,000 tons of steel ingots monthly.

IRON ORE

Of the total shipments of iron ore from the Lake Superior region in August, 8,115,686 tons, or 82.4% of the total, were received at Lake Erie ports.

COKE

Coke production in the Connellsville region week ended Sept. 16 is reported by the "Courier" at 393,447 net tons; shipments, 396,307 tons. Production is increasing slowly, as labor is scarce.

The H. Koppers Co., Pittsburgh, has received a contract from the Bethlehem Steel Co. for the erection of 60 byproduct coke ovens of the Koppers type at Steelton, Penn. Equipment will be installed for the recovery of several byproducts of coal. Early this month the Bethlehem Steel Co. placed a contract with the Koppers company for a byproduct coke plant of 240 ovens and a benzol recovery plant at Sparrows Point, Md.

Connellsville—The market has advanced sharply. For several days prompt furnace coke has been selling at $3.25, against sales a week ago at $2.85, with no higher than $3 quoted. A contract for high-grade furnace coke for first half has been put through at $3, while on three inquiries totalling 40,000 tons a month $3 and $3.25 is being quoted. Until recently consumers had expected lower prices for first half, when $2.50 and even a shade less had been done on the current half year. Foundry coke is up 25c. to $3.50 @3.75 for either spot or contract. The strength of coke is not due to any particular increase in demand, but rests upon the advance in the coal market, coupled with the shortage of labor at coke ovens. At present prices there is little profit in the coke over prices obtainable for raw coal.

Coal and Coke Tonnage Pennsylvania R.R. lines east of Pittsburgh and Erie, eight months ended Aug. 31, in net tons:

	1915	1916	Changes
Anthracite	6,811,293	7,767,748	I. 956,455
Bituminous	27,703,075	32,576,476	I. 4,873,401
Coke	7,222,840	9,682,236	I. 2,459,396
Total	41,737,208	50,026,460	I. 8,289 252

The total increase was 19.9%. The total August tonnage in 1916 was 6,467,709, an increase of 741,232 tons, or 12.9%, over last year.

Brisish Fuel Exports eight months ended Aug. 31, in gross tons:

	1915	1916	Changes
Coal	29,522,179	25,799,197	D. 3,722,982
Coke	576,218	1,019,896	I. 443,678
Briquettes	864,503	925,213	I. 60,710
Steamer coal	9,657,927	8,758,199	D. 899,728
Total	40,620,827	36,502,505	D. 4,118,322

The steamer coal is coal sent abroad for use of steamships in foreign trade, or delivered to such steamships in British ports.

Chemicals

NEW YORK—Sept. 27

The general market continues in a healthy condition. Heavy chemicals are in good demand with most prices steady.

Arsenic—Demand does not vary much at this season, but is fairly up to the current supply. Prices are unchanged at $6@6.25 per 100 lb., according to size of order, for both spot and futures.

Copper Sulphate—The export demand has died down and sales are chiefly to domestic consumers. Prices show little change, standard grades bringing $10@10.50 per 100 lb., according to size of order.

Nitrate of Soda—The market has been rather quiet during the week with only a moderate business forward. Prices are easier, $2.90@2.95 per 100 lb. being quoted for both spot and futures. Despatches from Chile give shipments for the eight months ended Aug. 31 as below, in gross tons:

To	1915	1916	Changes
Europe	546,300	877,400	I. 331,100
United States	595,950	786,300	I. 190,350
Total	1,142,250	1,663,700	I. 521,450

The total quantity afloat to Europe at the end of August was 278,500 tons.

Potash Salts—There is much interest in the reported discovery of a large deposit of potash salts at Montembo in Cuba. Should the reports prove true, the discovery will have a very important influence on the market here. German potash salts are practically unobtainable and a new supply will be welcomed.

Sulphur—The market continues very firm. High freight rates are still a factor. Quotations are $35 per ton, New York, for spot and $30 for futures.

Sulphuric Acid—Demand is good and prices are steady at $1 per 100 lb. for 60-deg. and $1.50 per 100 lb. for 66-deg. acid. Some concessions are said to have been made on large contracts for future delivery, sales of 66-deg. acid being reported at $25 per ton for future delivery.

Assessments

Company	Delinq.	Sale	Amt.
Andes, Nev.	Oct. 11	Nov. 1	0.02
Beaver Mines, Utah.	Sept. 30	Oct. 21	0.0025
Blue Star, Ida.	Sept. 25	Oct. 21	0.02
Boston Dev., Utah.	Sept. 27	Oct. 14	0.03
Buffalo Cons., Utah.	Sept. 23	Oct. 14	0.005
Bull Valley, Utah.	Oct. 10	Oct. 31	0.004
Cash Boy, Nev.	Sept. 1	Oct. 15	0.01
Chief Cons. Ext., Utah.	Oct. 10	Nov. 1	0.002
Colonial, Ida.	Aug. 26	Oct. 10	0.001
Comstock Cons., Utah.	Sept. 25	Oct. 10	0.0005
Con. Virginia, Nev.	Sept. 29	Oct. 20	0.05
Crown Point, Utah.	Sept. 16	Oct. 10	0.005
Eagle Mountain, Ida.	Oct. 2	Nov. 4	0.001
Giant, Ida.	Oct. 5	Nov. 9	0.003
Gold Bond, Utah.	Sept. 29	Oct. 24	0.001
Goldstrike Bon., Utah.	Sept. 25	Oct. 16	0.0025
Great Western, Nev.	Sept. 26	Oct. 18	0.01
Idaho-Nevada, Ida.	Sept. 14	Oct. 14	0.002
Independent, Ida.	Oct. 7	Nov. 7	0.005
Leonora, Utah.	Sept. 27	Oct. 16	0.005
Manhattan Cons., Nev.			0.01
Murray Copper, Utah.	Oct. 9	Nov. 8	0.001
North Tintic, Utah.	Oct. 10	Nov. 1	0.002
Neva, Utah.	Sept. 23	Oct. 10	0.002
Old Veteran, Ida.	Sept. 9	Oct. 7	0.002
Rio Grande Grubstake, Nev.	Sept. 22	Oct. 31	0.002
Royal Copper, Ida.	Sept. 22	Oct. 22	0.001
Sells, Utah.	Sept. 21	Oct. 7	0.06
Sierra Nevada, Nev.	Oct. 12	Nov. 2	0.10
Silver Pick, Nev.	Sept. 25	Oct. 30	0.01
Smuggler, Utah.	Sept. 20	Oct. 18	0.005
Spearhead, Nev.	Oct. 2	Nov. 2	0.01
Springfield Tunnel, Calif.	Aug. 15		0.05
Syndicate, Utah.	Sept. 18	Oct. 14	0.0015
Tarbox, Mont.	Sept. 28	Oct. 28	0.005
Tooele Chief, Utah.	Sept. 25	Oct. 10	0.001
Tonopah-Bonanza, Nev.	Sept. 19	Oct. 16	0.01
Tyler, Ida.	Sept. 12	Oct. 12	0.0015
Umatilla, Nev.	Sept. 18	Oct. 24	0.0025
Uvada, Nev.	Oct. 9	Oct. 26	0.02
West Toledo, Utah.	Sept. 12	Oct. 3	0.01
Diamondfield Bl'k B'tte, Nev.	Oct. 12	Nov. 18	0.01

Stock Quotations

SAN FRANCISCO Sept. 26 Name of Comp.	Bid.
Alta.	.04
Andes.	.08
Best & Belcher.	.05
Bullion.	.02
Caledonia.	.33
Challenge Con.	.08
Confidence.	.15
Cons. Imperial.	.01
Con. Virginia.	.13
Gould & Curry.	.03
Hale & Norcross.	.05
Jacket-Cr. Pt.	.06
Mexican.	.16
Occidental.	.70
Ophir.	.18
Overman.	.05
Savage.	.12
Seg Belcher.	.03
Sierra Nevada.	.25
Union Con.	.65
Utah Con.	.02
Belmont.	4.35
Jim Butler.	.85
MacNamara.	.05
Midway.	.20
Mont.-Tonopah.	.22
North Star.	.16
Rescue Eula.	.27
West End Con.	.77
Atlanta.	.09
Blue Bell.	‡.01
Booth.	.10
C.O.D. Con.	.02
Comb. Frac.	.06
D'field B.B.	.02
D'field Daisy.	.03
Jumbo Extension.	.37
Round Mountain.	.40
Sandstorm Kendall.	.03
Silver Pick.	.22
Central Eureka.	.08
Argo.	.10
Ariz. Central.	.15
Big Jim.	1.35
Lazy Boy.	.12
Oatman No. Star.	.09
Tom Reed.	2.00
United Eastern.	3 87½
United Western.	.09

LONDON Sept. 13	
Alaska-Mexican.	£1 3 9 1
Alaska Tre'dwell	5 7 6
Burma Corp.	3 19 4½
Cam & Motor.	0 11 6
Camp Bird.	0 8 0
El Oro.	0 10 0
Esperanza.	0 12 0
Mexico Mines.	3 15 0
Nechi, pfd.	0 12 9
Oroville.	0 16 9
Santa Gert'dis.	0 12 0
Tomboy.	1 2 0

SALT LAKE Sept. 25 Name of Comp.	Bid.
Alta Con.	‡.25½
Black Jack.	.06
Cardiff.	7.50
Colorado Mining.	.17
Crown Point.	.04½
Daly-Judge.	7.15
Emma Cop.	2.00
Gold Chain.	.17
Grand Central.	.62
Iron Blossom.	1.47½
Lower Mammoth.	.05
May Day.	.08
Opohongo.	‡.01
Prince Con.	1.40
Seven Troughs.	‡.03
Silver King Coal'n	2.85
Silver King Con.	3.45
Sioux Con.	.11
So. Hecla.	1.90
Uncle Sam.	.04
Wilbert.	.06
Yankee.	.16

COLO. SPRINGS Sept. 26	
Acacia.	.03¾
Cresson.	6.25
Doctor Jack Pot.	.09½
Elkton Con.	.14½
El Paso.	.49
Findlay.	.03¾
Gold Sovereign.	.06
Golden Cycle.	2.36
Granite.	.73
Isabella.	.22
Jack Pot.	.05½
Jerry Johnson.	‡.04
Mary McKinney.	.30
Portland.	2.00
Vindicator.	2.01

TORONTO Sept. 25	
Adanac.	‡25
Bailey.	.09
Chambers Ferland.	.20
Coniagas.	4.80
La Rose.	.59
Peterson Lake.	.22
Right of Way.	.05½
Seneca Superior.	.25
T. & Hudson Bay.	65.00
Temiskaming.	.62
Wettlaufer-Lor.	.11
Dome Exten.	.35
Dome Lake.	.57
Foley O'Brien.	.68¾
Hollinger.	6.90
Jupiter.	.29
McIntyre.	1.45
Newray.	.69
Porcu. Crown.	.75
Vipond.	.37
West Dome.	.38

N. Y. EXCH. Sept. 26 Name of Comp.	Clg.
Alaska Gold M.	13½
Alaska Juneau.	7½
Am.Sm.&Ref.,com.	113¾
Am. Sm. & Ref., pf.	115½
Am. Sm. Sec., pf. A	95
Am. Sm. Sec., pf. B.	87½
Am. Zinc.	43¼
Am. Zinc, pf.	77
Anaconda.	97½
Batopilas Min.	1½
Bethlehem Steel.	568
Bethlehem Steel, pf.	135
Butte & Superior.	64½
Chile Cop.	23½
Chino.	57½
Colo. Fuel & Iron.	56½
Crucible Steel.	92½
Dome Mines.	24¼
Federal M. & S.	16
Federal M. & S., pf.	40
Great Nor., ore ctf.	44½
Greene Cananea.	51½
Homestake.	133
Inspiration Con.	67½
International Nickel	53¾
Kennecott.	55¾
Lackawanna Steel.	84½
Miami Copper.	40½
Nat'l Lead, com.	70
National Lead, pf.	114¾
Nev. Consol.	23
Ontario Min.	7
Quicksilver.	2¾
Quicksilver, pf.	4½
Ray Con.	26½
Republic I&S, com.	69¾
Republic I&S, pf.	110¾
Sloss-Sheffield.	59
Tennessee Copper.	24¾
Utah Copper.	96½
U. S. Steel, com.	115
U. S. Steel, pf.	121
Va. Iron C. & C.	50

N. Y. CURB Sept. 26	
Beaver Con.	.45
Buffalo Mines.	.95
Butte & N. Y.	1¼
Butte C. & Z.	7¾
Caledonia.	.59
Can. Cop. Corpn.	1¼
Cashboy.	.06
Cerro de Pasco.	40
Con. Ariz. Sm.	1½
Con. Coppermines.	2¾
Con. Nev.-Utah.	.25
Crystal Cop.	1 3/16
First Nat. Cop.	5½
Florence.	.76
Goldfield Con.	.71
Goldfield Merger.	.08
Granite.	.20
Hecla Min.	5¼
Howe Sound.	5
Jerome Verde.	2 3/16
Joplin Ore & Spel.	.52
Kerr Lake.	4 11/16
Magma.	19
Majestic.	.63
McKinley-Dar-Sa.	.65
Mother Lode.	.38½
Nevada Hills.	.21
N. Y. & Hond.	15½
Nipissing Mines.	8¾
Oro.	.03
Ray Hercules.	4¼
Rochester Mines.	.50
St. Joseph Lead.	17½
Standard S. L.	1 7/16
Stewart.	.25
Success.	.39
Tonopah.	5½
Tonopah Ex.	5 7/16
Tribullion.	⅜
United Verde Ext.	42½
United Zinc.	5
White Knob, pf.	1¾
White Oaks.	5½

BOSTON EXCH Sept. 26 Name of Comp.	Bid
Adventure.	4½
Ahmeek.	107
Algomah.	1½
Allouez.	68½
Ariz. Com., ctfs.	12¾
Bonanza.	.38
Butte-Balaklava.	1¾
Calumet & Ariz.	76
Calumet & Hecla.	585
Centennial.	19
Copper Range.	68½
Daly West.	2¾
East Butte.	15¾
Franklin.	9
Granby.	93½
Hancock.	14½
Helvetia.	.25
Indiana.	3
Island Cr'k, com.	42½
Island Cr'k, pfd.	90
Isle Royale.	36
Keweenaw.	6½
Lake.	13½
La Salle.	4½
Mason Valley.	4¾
Mass.	15½
Mayflower.	2¾
Michigan.	3¾
Mohawk.	94½
New Arcadian.	7½
New Idria.	16
North Butte.	23
North Lake.	2
Ojibway.	1¾
Old Colony.	2
Old Dominion.	70½
Osceola.	95¾
Quincy.	91½
St. Mary's M. L.	88½
Santa Fe.	2¾
Shannon.	9¾
Shattuck-Ariz.	32½
So. Lake.	6
So. Utah.	.36
Superior.	17½
Superior & Bost.	5¾
Tamarack.	42
Trinity.	7¾
Tuolumne.	.59
U. S. Smelting.	77
U. S. Smelt'g, pf.	52½
Utah Apex.	4
Utah Con.	14½
Utah Metal.	6¼
Victoria.	4
Winona.	5
Wolverine.	48½
Wyandot.	1¾

BOSTON CURB Sept. 26	
Bingham Mines.	11¾
Boston Ely.	1
Boston & Mont.	1
Butte & Lon'n Dev.	.59
Calaveras.	5¾
Calumet-Corbin.	.02½
Chief Con.	2
Cortez.	.40
Crown Reserve.	.56
Davis-Daly	2
Eagle & Blue Bell.	1¾
Houghton Copper.	1¾
Iron Cap Cop., pf.	5½
Mexican Metals.	.31
Mines of America.	2½
Mojave Tungsten.	4 3/16
Nat. Zinc & Lead.	1
Nevada-Douglas.	1 11/16
New Baltic.	1½
New Cornelia.	17½
Ohio Copper.	.15
Oneco.	.75
Raven Copper.	‡.07
Rex Cons.	.34
Rilla.	.14
Yukon Gold.	2½

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York 1914	New York 1915	New York 1916	London 1914	London 1915	London 1916
January.	56.572	48.855	56.775	26.553	22.731	26.960
February.	57.506	48.477	56.755	26.573	22.753	26.975
March.	58.067	50.241	57.935	26.788	23.708	27.597
April.	58.519	50.250	64.415	26.958	23.709	30.662
May.	58.175	49.915	74.269	26.704	23.570	35.477
June.	56.471	49.034	65.024	25.948	23.267	31.060
July.	54.678	47.519	62.940	25.219	22.597	30.000
August.	54.344	47.163	66.083	25.979	22.780	31.498
September.	53.290	48.680	.....	24.260	23.591	.....
October.	50.654	49.385	.....	23.199	23.925	.....
November.	49.082	51.714	.....	22.703	25.094	.....
December.	49.375	54.971	.....	22.900	26.373	.....
Year.	54.811	49.684	.....	25.314	23.675	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York Electrolytic 1915	New York Electrolytic 1916	London Standard 1915	London Standard 1916	London Electrolytic 1915	London Electrolytic 1916
Jan.	13.641	24.008	60.756	88.083	65.719	116.167
Feb.	14.394	26.440	63.494	102.667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April.	16.811	27.895	75.096	124.319	*	137.389
May.	18.506	28.625	77.600	135.457	*	152.522
June.	19.477	26.601	82.574	112.432	95.333	137.455
July.	18.796	23.865	76.011	95.119	91.409	125.500
Aug.	16.941	26.120	68.673	110.283	82.333	126.304
Sept.	17.502	.....	68.915	.....	85.250	.....
Oct.	17.686	.....	72.601	.....	88.000	.....
Nov.	18.627	.....	77.744	.....	93.273	.....
Dec.	20.133	.....	80.773	.....	100.43	.....
Year.	17.275	.....	72.532	.....	.....	.....

TIN

Month	New York 1915	New York 1916	London 1915	London 1916
January.	34.260	41.825	156.550	175.548
February.	37.415	42.717	176.925	181.107
March.	48.426	50.741	180.141	193.609
April.	47.884	51.230	166.225	199.736
May.	38.790	49.125	162.675	196.511
June.	40.288	42.231	167.636	179.466
July.	37.423	38.510	167.080	168.357
August.	34.389	38.565	151.440	169.870
September.	33.125	.....	152.625	.....
October.	33.080	.....	151.554	.....
November.	39.224	.....	167.670	.....
December.	38.779	.....	167.000	.....
Av. year.	38.590	.....	163.960	.....

LEAD

Month	New York 1915	New York 1916	St. Louis 1915	St. Louis 1916	London 1915	London 1916
January.	3.729	5.921	3.548	5.826	18.606	31.167
February.	3.827	6.246	3.718	6.164	19.122	31.988
March.	4.053	7.136	3.997	7.375	21.883	34.440
April.	4.221	7.630	4.142	7.655	21.094	34.368
May.	4.274	7.463	4.182	7.332	20.347	32.967
June.	5.932	6.936	5.836	6.749	25.170	31.011
July.	5.659	6.352	5.531	6.185	24.611	28.137
August.	4.656	6.244	4.520	6.088	21.946	29.734
September.	4.610	.....	4.490	.....	23.151	.....
October.	4.600	.....	4.499	.....	23.994	.....
November.	5.155	.....	5.078	.....	26.278	.....
December.	5.355	.....	5.266	.....	28.807	.....
Year.	4.673	.....	4.567	.....	22.917	.....

SPELTER

Month	New York 1915	New York 1916	St. Louis 1915	St. Louis 1916	London 1915	London 1916
Jan.	6.386	16.915	6.211	16.745	30.844	89.810
Feb.	8.436	18.420	8.255	18.260	39.819	97.762
Mar.	8.541	16.846	8.360	16.676	44.141	95.048
April.	10.012	16.695	9.837	16.525	49.888	99.056
May.	14.781	14.276	14.610	14.106	68.100	94 217
June.	21.208	11.752	21.038	11.582	100.614	68.591
July.	19.026	8.925	18.856	8.755	97.250	50.750
Aug.	12.781	8.730	12.611	8.560	67.786	51.587
Sept.	13.440	.....	13.270	.....	67.841	.....
Oct.	12.800	.....	12.596	.....	66.536	.....
Nov.	15.962	.....	15.792	.....	88.409	.....
Dec.	15.391	.....	15.221	.....	89.400	.....
Year.	13.230	.....	13.054	.....	67.553	.....

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. * Not reported.

PIG IRON IN PITTSBURGH

Month	Bessemer‡ 1915	Bessemer‡ 1916	Basic‡ 1915	Basic‡ 1916	No. 2 Foundry 1915	No. 2 Foundry 1916
January.	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February.	14.55	21.16	13.45	18.93	13.90	19.51
March.	14.55	21.81	13.45	19.20	13.95	19.45
April.	14.55	21.65	13.45	18.95	13.95	19.45
May.	14.61	21.78	13.60	19.11	13.83	19.58
June.	14.70	21.95	13.67	18.95	13.77	19 34
July.	14.94	21.95	13.91	18.95	13.68	19.20
August.	16.01	21.95	15.31	18.95	14.75	19.25
September.	16.86	.....	15.95	.....	15.70	.....
October.	16.95	.....	15.96	.....	15.80	.....
November.	17 57	.....	16.47	.....	17.20	.....
December.	19.97	.....	18.44	.....	18.95	.....
Year.	$15.82	.....	$14.76	.....	$14.95	.....

‡As reported by W. P. Snyder & Co.